

**Organisations and Networks: Theoretical Considerations
and a Case Study of Networking across Organisations.**

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of Doctor of Philosophy**

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Abstract

This dissertation considers the rise of new and emergent organisational forms characterised as networks. The work presents an analysis of the underlying themes that motivate such developments by drawing upon modern models of organisation together with contemporary perspectives on information systems. A network is seen as interlinked work processes supported by communication technologies; work processes which, in particular, can transcend space and time and enable team based approaches. The characteristics that might distinguish the network are set out in terms of technology, the nature of the work process, and approaches to traditional organisational functions. Associations of individuals, institutions and groups of people and institutions; and societal considerations affecting inter-governmental and regional developments are also considered. An analysis of these characteristics is presented within a layered model and further developed by the use of tools and techniques drawn from social network analysis.

A detailed case study is presented using this theoretical approach. The case examined is the Commonwealth Network of Information Technology for Development (COMNET-IT). This is an initiative of the Commonwealth aimed at bringing together expertise and organisations from around the world to coordinate their efforts in utilising information technology in pursuit of development goals. The focus of COMNET-IT's activities is on adding value to the work of a group of geographically dispersed experts through the utilisation of electronic networks.

The study provides a detailed theoretical analysis of the network phenomenon. Using structuration theory and social network analysis, this research provides insights into processes of network formation and evolution, network structure and the behaviour of network participants. The processes of appropriation of technology are observed and analyzed, and this work is supported by detailed empirical research investigating electronic group meetings.

To Gert-Jan, whose enthusiasm and confidence have motivated me enormously.

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Chapter One:

Introduction

Chapter One: Introduction

Introduction

This dissertation looks at human networks and the patterns of relations that develop within loosely coordinated multi-organizational work processes and are supported by information technology. The analysis is presented at various levels: technical, work process, organisational, associational and societal. The work takes the structure of interpersonal relations as the focal point from which to investigate the way in which information flows and is transformed. This approach addresses organisational concerns using structuration theory in conjunction with social network analysis (also known as structural analysis) to observe patterns of relations and draw conclusions about the structure of a network in relation to the behaviour of social actors. The aim of this dissertation is to develop an understanding of why people and groups behave in the ways that they do in a network environment, and not to prove a general or normative "theory". The purpose of the approach to networking developed in this dissertation is to arm the reader with an understanding of the processes that underlie the development and use of electronic communications technology. In so doing, one of the expected contributions of this research is to provide an approach for investigating networks from which practical insight into networking and electronic group processes may arise.

Networks have usually been described and analyzed within an approach based on traditional organisation theory. In the contemporary literature, the term *organisation* is often used to describe network processes (Charan 1991, Drucker 1988). However, for the purpose of investigating the network phenomenon, organisation theory alone appears to be inappropriate for describing the ways in which people are grouped together and collaborate to perform their activities. The term organisation gives the notion of a well defined set of activities and processes that operate under the control and supervision of people with well defined responsibilities and within well defined boundaries (Child 1984, Pugh 1984). But both the physical boundaries and authority structures suggested by the organisational paradigm are not always present.

Within this organisational paradigm, information systems development has largely

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restricted itself to addressing formal information flows and requirements (Hirschheim 1985, 1989). The resulting information systems often fail to be used largely in part because they do not respond to the powerful social forces that govern the development and life of the organisation (Walsham 1991). This leaves practitioners at a loss when faced with information systems failures. It is widely accepted that there are strong social forces that demand a greater understanding than that afforded by the technical skills of the information systems professionals. Participatory mechanisms (Land and Hirschheim 1983, Checkland and Scholes 1990) and socio-technical design methodologies (Mumford and Weir 1979, Trist 1982, Avison and Wood-Harper 1990) have attempted to take this into account to enable the development of more appropriate information systems. But the fact remains that traditional notions of cost and benefit (see Earl 1989), which many organisations are accustomed to following, restricts the applicability of such approaches. Participatory mechanisms may take up a great deal of resources (mostly time and money) and cannot always be justified as the immediate benefits (to profits or efficiency gains) cannot be identified.

The powerful influence of social factors is not restricted to work processes within organisations. This influence extends beyond individual organisations into associations of people and organisations that are often geographically dispersed. In particular, these forces manifest themselves within the increasingly popular electronic media (Hiltz and Turoff 1993, 1992). The changing nature of the work and business environment leads to networks of communication and interpersonal links that combine and include people from a number of organisations. Work processes that encompass a number of different types of skill, knowledge and sources of information have become an integral part of many working environments. Looking beyond organisations towards patterns of communication between individuals, groups and even nations, one is faced with the need for a more appropriate means of approaching interpersonal interactions and of exploring their structures.

Research Approach and Case Study

This research follows an interpretivist strategy using a single case study containing different types of networks and forms of networking. An interpretivist strategy enables human networks, and their relation to the different aspects of networking (technology, work, organisational, association and society), to be considered. As research into networking of this type is still in its formative stages, the use of a case study is valuable in that a real world situation is described and used to focus the analysis. The case study is not used in this research to validate a theory or hypothesis but it is used to generate conceptual insights which may apply to other situations. In this way, it is possible to offer explanations for why certain patterns of behaviours occur. In order to arrive at generalisations, the case study has been carefully designed to offer representativeness and rigour. A layered model of networking is developed through which the network is described in terms of five levels: the use of technology, the nature of the work process, organisational functions, associational and societal perspectives. This model is intended to guide the researcher in investigating the network phenomena and to provide insight into the nature of the evolving network structures and the role of electronic communications technology.

The five levels of networking provide a basis for the researcher to describe and to interpret the case study, and in this way the researcher does not impose a single *a priori* understanding of the situation. The network phenomena are examined in their natural setting and the researcher is part of the phenomena being investigated. She describes the case study from her position as coordinator of this network since August 1992. The case study, described in chapter five, is known as the Commonwealth Network on Information Technology for Development (COMNET-IT). This network is composed of a loosely defined set of activities situated in different parts of the world that were, at the time of this research, administered by the COMNET-IT coordinating centre at the Commonwealth Secretariat in London. The function of COMNET-IT was to set up and coordinate networking projects, and at the same time serve as an instrument for setting the direction and encouraging other networking activities. COMNET-IT itself is

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composed of a number of separate networking initiatives, which together provide a broad, rich domain of investigation for this research.

The Network Concept

Before conducting the research of this dissertation, it is necessary to first consider the various ways in which the term *network* is used and focus on a set of definitions that are appropriate for the purpose of this research. After a brief description of the different ways in which the network concept has been used, special consideration is given to understanding networks as social phenomena emerging from the widespread use of electronic communications technologies. This understanding is then used to inform definitions of networking in which the various network concepts are synthesised into the five levels.

It is customary to refer to a chain of interconnected people or operations as a network (Oxford English Dictionary). Interpersonal ties are often seen as networks in themselves and exhibit structures by way of the relations which they exhibit. This broad notion of a network has become popular in recent years in a number of areas ranging from sociology, management and organisational redesign to computer networks and electronic messaging. A common feature in all these is that they endeavour to link, and often monitor activities, that are dispersed across a number of people, groups, departments, organisations, and even countries and regions.

Technical networks

The structure of a network may be expressed as basic configurations drawn from graph theory. Such notions are used in a number of areas that deal with networks (ie computer networks). The map, tree (a cyclic), circle or ring, line and star are forms of these configurations. This very technical concept of the network is often used to express electronic networks. Ranging from the mass of telecommunications networks to the more local area networks that link up a collection of computers, the realm of these networks is pervasive. These are considered in more detail in subsequent sections.

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Network organisations

At the same time, the concept of a network is increasingly being used to describe work settings that are not bound by traditional organisational structures. The term *network* as a means of describing a form of organisation has become popular amongst management writers and practitioners (Drucker 1988, Kanter 1983, Scott-Morton 1991, Sproull and Keisler 1991a, Coulson Thomas 1991, Charan 1991) as well as organisational theorists (Handy 1985, Morgan 1989, Mastenbroek 1987). This work is based in part on this notion that networks are an appropriate means of describing the complex interrelations among people who work together on the same activities and towards similar ends.

The business management literature approaches the concept of a network from the perspective of how people interact in pursuit of a more or less given task. They look at networks as teams, or the movement of people between parts of an organisation, and in between organisations, and as the integration of parts (Rockart and Short 1991, Kanter 1983, Lawrence and Lorsch 1967). More recently, the network is seen as enabling or expressing a new way of working (Drucker 1988, Porter and Millar 1985) in which there is greater interaction and exchange of information (Kiesler and Sproull 1991b). The network form of organisation is usually seen to be flat, non hierarchical and information rich. In view of its claimed adaptability to change and ability to transmit and learn new knowledge and skills, this form is seen as meeting the challenges posed by the information age (Drucker 1988). Thus it is argued, in an age where knowledge and information are the basis of wealth and power, the ability to learn and acquire information have to be accompanied by new ways of working and organisation that allow instantaneous access to information resources (Tofler 1984).

Networks for control

The concept of the network has been used as a means of facilitating the control of activities within organisations such as production processes. The project management literature considers the network as composed of links between different tasks performed

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within a given work setting. Deriving much of their work from graph theory, project management writers and practitioners have used network concepts for decades to describe how a series of tasks are performed within a given set of guidelines over a predefined period of time. PERT/CPN graphs are an example of using network modelling techniques to monitor and control work processes (Levin and Kirkpatrick 1977). Even Petri-nets have been used to this end as described in Berkeley *et al.* (1990). The use of petri-nets for the purpose of monitoring processes has been described in four layers of networking in Qureshi (1992).

Networks for exchange and coordination

Another way of looking at network structure is as a means of coordination. As stated by Thompson *et al.* (1991), such coordination needs may be served by a hierarchy, market or it may be a network. In this view, network forms of organisation comprise of informal relations, bonds or cliques among the social actors in a community. Network structure at this level expresses distinct characteristics relating to both operation and behaviour. In an insightful comparison of three forms of organisation: markets, hierarchies and networks, Walter Powell (1991) suggests that networks are particularly appropriate for circumstances in which there is a need for efficient, reliable information. They suggest that (in Thompson *et al.* 1991, p.272):

Networks, then, are especially useful for the exchange of commodities whose value is not easily measured. Such qualitative matters as know-how, technological capability, a particular approach or style of production, a spirit of innovation or experimentation, or a philosophy of zero defects are very hard to place a price tag on... The open-ended relational features of networks, with their relative absence of explicit quid pro quo behaviour, greatly enhance the ability to transmit and learn new knowledge and skills.

According to Thompson 1991, the network form appears to have some very distinct characteristics. In contrast to either market or hierarchy, networks coordinate activities

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through less formal, more egalitarian and cooperative means. The ways in which these features operate in a range of different environments and contexts are explored by the sociological tradition of network analysis which outlines the manner in which network structures are formed and operate (Thompson *et al.* 1991). The notion of markets, hierarchies and networks is also explored by Malone and Yates (1987) from the perspective of organisational forms. This view is further developed in Malone (1991), in which the network form of organisation is seen as means of increasing organisational competitiveness (Venkatraman 1991, Macdonald 1991) and for managing organisational interdependence (Rockart and Short 1991) as an alternative to the other two forms of organisation.

Human networks

At the basis of these forms of coordination are human networks. These are characterised by relations between individuals and groups (Berkowitz 1982, Knoke and Kulksinki 1991, Burt 1983) by information exchange and by a process of acquiring knowledge and learning (Lane 1992, Argyris 1977, 1980). Within such human networks, relations of collaboration, power and control manifest themselves in a number ways. They bring forth patterns of behaviour that can be understood to be typical of the context within which people interact. It is argued that (Segars and Grover 1994) the communication relations, level of information exchange and the collective learning processes among the members combine to develop the identity of the human networks and their behaviour.

Blair *et al.* (1985), provide a useful definition of human networks. These they state, are "sets of relatively stable contacts among people through which information is generated and flows" (In McPhee and Tompkins 1985 vol 13). This notion of networks is central to this research in that structure is seen to comprise of a set of communication relations that take the form of a network. As stated by Knoke and Kuklinski, (in Thompson *et al.* 1991, p.175):

A network is generally defined as a specific type of relation linking a defined

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set of persons, objects or events. Different types of relations identify different networks, even when imposed on an identical set of elements.

A network in this sense, is a means of capturing some of the underlying forces of social interaction that define the communication relations among the actors in a social setting. In this way, the network may be seen to represent different communication relations depending upon the aspect or process being investigated.

Networks in cooperative work processes

The encouragement and development of communication relations has taken place largely within organisations often facilitated by group support systems built upon local area network technologies. Currently, a large amount of research is being undertaken in the area of Computer Mediated Communication (CMC). This reflects the need for a theoretical basis upon which the process of communication using electronic communications technology can be studied. An influential, and, according to Rice (1992), the most fully developed theoretical process models of CMC research is Poole and DeSanctis's (1990) theory of adaptive structuration. In their studies of group processes involving Group Decision Support Systems (GDSS) technology, Poole and DeSanctis suggest that there is no direct deterministic effect of this technology and the form and application of technology are dependent upon the choices made by participants or group members. CMC technologies can enable various ways of working, by way of the tools that they make available for the group members, but the actual use made is conditioned by other forces.

Rice explains, that because CMC systems may involve communication among participants across organisation and national boundaries, CMC research should explicitly consider appropriate and multiple levels of analysis (Rice 1992). Contractor and Eisenberg (1990) propose that there are three levels of interaction - individual, dyadic and group that are needed to understand the processes by which participants in a group meeting structure their discussions on the electronic media. From a survey of the literature, Er (1989)

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compiles evidence on the impact of computing and information systems and groups them into four levels of analysis: individuals (ergonomics, attitudes and behaviour), groups (industrial relations and technological changes, impact on top management, expert power of computer professionals), organisations (intra-organisational power, organisational structures) and society. A similar view of levels is also used by Kerr and Hiltz (1982) to analyze their results from studies of computer conferencing systems. They identify three general types of potential consequences - cognitive, affective and behavioural, but report few studies at the societal level of analysis. Rice contends that the levels of analysis approach provides a useful context for organising the literature and research results. He adds that, these concepts also represent an insight into the more fundamental issues of where the adoption, use and implications of this new medium of communication primarily take place.

Electronic Communications and Human Networks

Electronic communications technology is a very significant contributor, from whatever view point networks are approached, to this very ubiquitous concept of a network. In recent years, electronic communications technologies have expanded into the home and office as providers of services. More significantly, they are seen to open up a new environment allowing a range of interactions to come into play. Newsweek (September 1993) dedicated a special section to reporting the 'wired lives' of 12 million Americans living 'on-line'. An excerpt states that:

The net is a communications marvel patched together in an almost anarchic fashion. Lawyers and politicians are still trying to figure out whether to govern or to police it; no one can predict the ultimate social consequences.

The electronic communications technology has given rise to a *social space* (Harasim 1993) that resides on 'the net'. Composed of a myriad of networked computers, the net is an immense carrier of vast amounts of information. It has emerged from a forum of scientific research, to one of political debate, stock tips, advice and a multitude of user

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groups (Kantrowitz *et al.* 1993). Many people, and not just academics, have recognised that the electronic network has emerged as a potentially powerful medium of communication that creates networks of people that are often situated in different parts of the world. *Electronic information highways* is the term that is commonly referred to by electronic networking enthusiasts and writers in the field of electronic communications who participate in the creation and circulation of vast quantities of information that flows along these wires (Egan 1991). The scope for communication and the creation of social linkages among these people is enormous and largely under researched.

Effects of electronic mail

According to Sproull and Kiesler (1991b), communication technology differs from earlier ones (hieroglyphics, papyrus and the printing press) in the greater degree to which, through computer processing power, they span space, time and preexisting social arrangements. They have identified levelled effects of the technology.

First-level

'First-level effects' of communication technology are the anticipated technical ones. These are the planned efficiency gains or productivity gains that justify an investment in new technology. Conventional cost displacement or value-added analysis often underlies the calculation of these gains. For example a firm that considers installing a voice mail system might estimate how much money could be saved by replacing telephone operators, secretaries (cost displacement analysis) or it would calculate the additional jobs those employees could do when they no longer had to answer the phone (value added analysis).

Enormous difficulties plague such analysis. Cost estimates of new technologies typically underestimate implementation costs of training and conversion to new ways of working even when they do not underestimate installation costs. More particularly, such analyses have no means of recognising the various ways in which this new technology allows people to work; these are often not conceivable prior to the use of this technology.

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Sproull and Kiesler (1991b p.21,24) explain that electronic communications have the added effects of:

1) accelerating information flow because it is easy to send a message to a group as it is to a single person and,

2) regularising information flow because the time it takes for transactions to be carried out is reduced significantly.

Second-level

They then go on to describe 'second-level effects' of communication technologies that come about primarily because new communication technology leads people to pay attention to different things, have contact with different people, and depend on one another differently. Change in *attention* means change in how people spend their time and in what way they think is important. Change in *social contact* patterns means change in who people know and how they feel about them. Change in *interdependence* means change in what people do with and for each other and how these functions are organised in norms, roles, procedures, jobs and departments. New and changed roles affect not only those who occupy them but also those who interact with them or are displaced. Patterns of information exchange are changed as are working and social relationships. Thus, social and organisational structure is changed. So are perceptions of who is important, what is legitimate, what is prestigious (Sproull and Kiesler 1991b).

Coordination costs

Sproull and Kiesler (1991b) add that, in particular, group mail has the effect of reducing coordination costs. They claim that groups incur coordination costs defined as the time and money necessary to organise and sustain group activity. Coordination costs are measured in terms of process loss which is the difference between the potential contribution of all group members and their actual contribution. This cost, they suggest, has been known to reduce through the use of email for scheduling, task assignments,

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reporting accomplishments and for general awareness of the progress of the group project. In this respect the technology supports organisational structures and facilitates the operation of organisational processes and procedures, especially in coordinating dispersed activities and group operations.

If the above is true, then it should be possible to carry out traditional organisational functions using electronic communication technology to coordinate the work of people working in different geographical locations. It appears that on the one hand, there are efficiency gains to be had from the electronic communication technologies and, on the other hand, there are a host of hidden costs that only manifest themselves after the technology has been implemented. Sproull and Kiesler's analysis appears to overlook the fact that the hidden consequences of facilitating communication are often determined by the ways in which the communication technologies are used. The social context within which communication takes place has a considerable influence on the effects of this technology. In short, the technology alone cannot be seen to have far reaching effects because the social structures in place have a considerable influence on the patterns of behaviour that emerge from using the technology.

Social cues

Computer mediated communication cannot overcome the possibilities provided by non-verbal communication. According to Hiltz and Turoff (1993) people who are not used to the electronic media find that they have to do without the basic regulating mechanisms that exist for face to face communication. These are described by Hiltz and Turoff (1993) as 'turn-yielding cues' that regulate the pace at which communication proceeds. Turn-yielding cues are described as facial expressions, eye contact, body movement and voice. These play a very important role in communication processes and often have to be substituted on the electronic media in order to convey the intended meaning of the message.

In addition, social cues that are conveyed visually do not exist in computer mediated

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communication, especially among a group of people who have never physically met each other. This has the advantage of not prejudicing individuals who are not very loud, or attractive in appearance. Dominance on the electronic media takes on a rather different set of criteria. Typing skills and ability to cope with delays on the interactive media are a few of the necessary criteria towards being able to interact on the electronic media. In their study of electronic meeting systems, McLeod and Liker (1992) found that:

1) Manually supported groups showed significantly higher percentages of task oriented behaviours than did the computer supported groups,

2) Computer-supported groups perform better on the project planning task than did the unsupported groups. Furthermore the performance of the computer supported groups was significantly less variable than the performance of the unsupported groups.

3) Manually supported groups wrote responses that were significantly longer, and also wrote more completely formatted letters and memos in response to items of knowledge and skill, effort, task strategy and satisfaction. There was a trend in the data suggesting that the responses of the manually supported groups showed a greater awareness of the underlying problems.

Defining the social context

In addressing the way in which human networks evolve in relation to electronic communications technology, we must consider the social context. In assessing the dynamics of context-behaviour interactions in computer mediated communication, Fulk *et al.* (1992) propose that the conceptualisation of context incorporates a broad array of elements including two important dynamic elements:

1) communication behaviour is influenced by its own historical context and by the history of its social context, and

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2) action not only responds to context but also helps create new contexts which then influence behaviour. It can therefore be deduced that action is embedded in a dynamic reciprocal relationship with context.

This means that the social structures that evolve within a context create patterns of behaviour which in turn affect the way in which social structures develop. If the use of communications technology reflects the social processes that are already in place, it might be said that the patterns of interaction that occur using the communications technology may not be very different from face to face or verbal communication. Communication on the electronic media can be seen to bring about *social spaces* (Harasim 1993) upon which a host of social interactions take place. And yet, in most cases, there is a difference in the way people interact with each other on an *electronic social space* (a notion to be developed further in this dissertation) than in face to face communication. These may be compared to *electronic social fields* that are described by Perin (1991), as transcending organisational discipline and control. In a traditional organisational context these are often fraught with suspicion and resistance by management. However, in the context of a network form in which there is a need to coordinate geographically dispersed activities on a regular basis, the electronic social space emerges as a very real phenomenon.

In summary, it can be said that the use of computer mediated communication can be very specific. It cannot entirely replace face to face communication for particular types of work and activities. While at the same time it makes possible the achievement of certain activities without necessarily having face to face meetings. The structure inherent in social networks may be altered with the use of electronic communications technologies. The social processes that give rise to these structures and the behaviour of the network as a result, may be a determining factor in the way in which communications technologies bring about new working patterns. This insight will be used to guide the analysis of human networks supported by electronic communication technology.

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Networks as Dynamic Entities

All the above suggests that it is worth considering the formal elements of network structure in conjunction with the more informal elements when assessing the behaviour of a network and its ability to carry out its required function. In order to analyze networks it is useful to construct a conceptual model or framework to decipher the mass of detail that is inevitably observed. In as much as the search for certainty only adds to the overall complexity of the process being redesigned, it is still worth using formalisms as a means of interpreting situations and representing them (Angell and Smithson 1991). As stated above, networks are in a constant process of being developed, adjusted, and readjusted according to the circumstances in which they exist, and an effective model will have to look at their dynamic properties.

The process of network formation may be seen as the development of human networks: their use over time, their generation, their regeneration and their distribution. Communication among actors who are part of a network can be described as a form of networking. Networking is a dynamic process in which communication channels form, are used and are reformed and adapted. In this way, the development of patterns of communication, and of infrastructure to support them, can be regarded as a form of networking just as are the development of informal working relationships. Networking is then a means by which the structure of human networks readjusts itself to changing circumstances.

Aspects of Networking

Networks may casually evolve as individuals or organisations collectively respond to changing circumstances, or they may be part of a premeditated effort by management or other sponsors to integrate parts. Alternatively there may be networks of people that transcend a number of organisations, but which function to some degree as a single work process. For example, in the case of a consortium of builders for a construction contract or in the case study offered in this thesis. In this section, a process view of networks is put forward in the light of the different ways in which the network concept is used. In

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attempting to analyze this very general phenomena of networking, it is necessary to be able to distinguish what aspect of a network one is observing: whether it is technical, human, organisational or associational, and what societal aspects they have to adjust to. In order to distinguish the nature of networks and the forces that drive them, it is necessary to provide a means of understanding the various elements present in network structure.

To guide the investigation of networks in this research, an approach of levels is developed in the following sections and used in the dissertation as a means of perceiving different instances of networks and the many ways of referring to the network phenomena are explored within this approach. Although the levels are similar to those of Er (1989), and Kerr and Hiltz (1982) described earlier, this approach differs in that it enables distinct instances of networking may be distinguished from real world situations. The levels of this approach are those of:

- ***Technology***
electronic communications, technical processes

- ***Work***
people, projects, team based activities, work processes

- ***Organisation***
structure, resources, culture, adaptability, accountability, control

- ***Association***
value added alliances, strategic alliances, resource sharing

- *Society*
*integration of information economy, regional
development, policy, global civil society*

In order to provide a means of understanding the various elements present in a network structure, each of the above levels of networking will be described in the following sections. At first, a brief description of the levels of networking is provided with an example to illustrate this approach. The initial description is then followed by a more detailed account of networking at each of the five levels.

The ramifications of electronic networking and the human networks that it supports, creates and strengthens is too complex to be perceived in its entirety within a single frame of reference. The process of networking can, however, be dealt with in a more comprehensible manner by carefully defining the context at each of the levels within which the networks are being investigated. In this way, the researcher will be able to identify the salient instances of networking as they present themselves at each level. By starting at the lowest level, that of the technology and working our way up to the more abstract societal phenomena, we can create a conceptual model of networking: its components, characteristics and the forces that drive the network form.

This approach of levels does provide us with a very simple means of addressing the softer, intangible, and emergent properties of networking while at the same time taking into account technical considerations of a more designed, physical nature. We can use this approach of levels to describe the phenomenon we investigate in terms of features of networking and how they relate to each other. An illustration of this approach of levels is provided in figure 1.

From the *technical perspective* the process of linking up people through the use of electronic networks and electronic messaging technology, is viewed. The technical characteristics of networks are identified and their properties distinguished. Computers

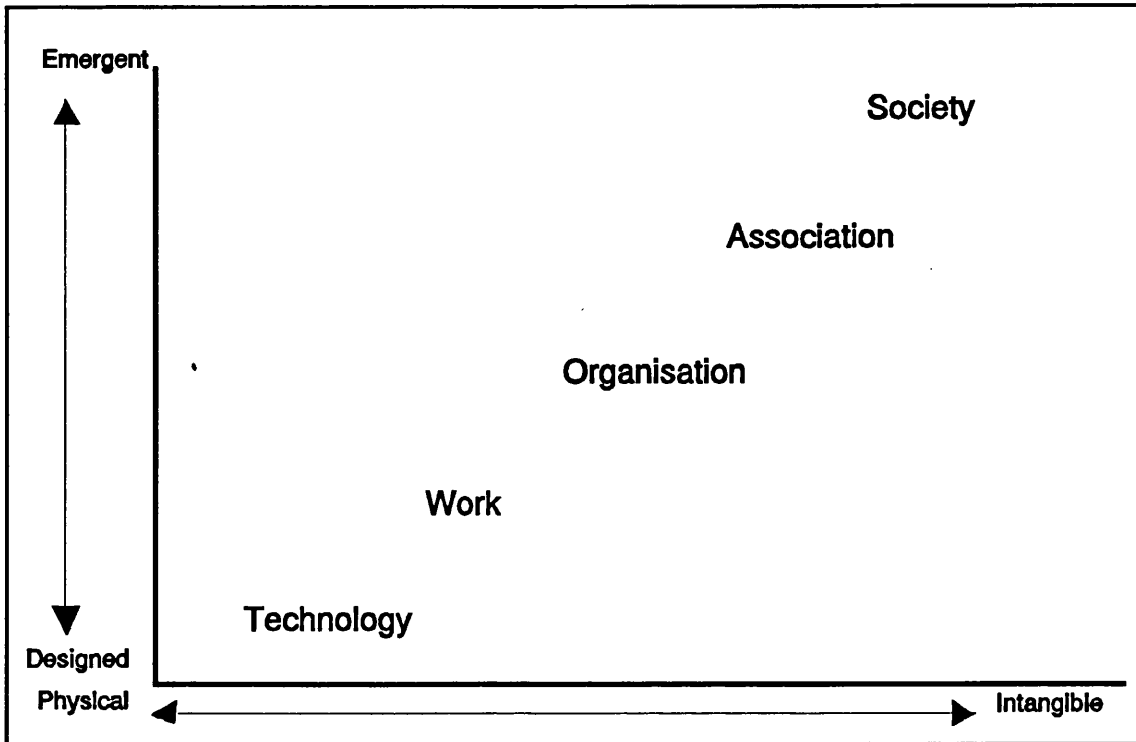


Figure 1 : Layers of Networking

may be linked together in a number of ways resulting in varying degrees of functionality. Factors such as the speed of transmission of electronic data, protocols of type of connection supported, their security and ability to be transported across a number of different types of networks are essential. In the development of electronic communication links, these considerations are important in ensuring that the means of communication deliver appropriate functionality and are useable.

The *work process* considers how people are linked together, and how these fulfil the task requirements. The communication relations among people involved in a particular task or series of activities reflects their values, norms and position on social structures. Although these relations may not necessarily be supported by communication technology, the technology can play an important part in shaping linkages among a network of social actors. At the same time, work processes in general are being transformed by the electronic communications technologies that have become available. The proliferation of computers, together with attempts to support these new ways of working, have bought

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about an even greater number of tools to support these changing work processes. A plethora of such tools have emerged under labels of Group Support Systems (GSS), Computer Supported Cooperative Work (CSCW), meeting support systems, workflow systems, and general groupware, to name just a few (Grudin 1994, Bostrom *et al.* 1992, Hiltz and Turoff 1992)

Organisations may be seen as collections of human networks. The process of integrating these collections of networks are known as integrating mechanisms. Authors such as Kanter (1983), Lawrence and Lorsch (1967) and others refer to integrating mechanisms as specialised departments within organisations that ensure that there is interpersonal communication among people from different departments. In addition to integrating mechanisms, Kanter (1983) identifies job mobility, and employment security as network forming devices. Furthermore, strong information technology capability has been suggested as a force that binds the organisation together (Scott-Morton 1991, Ernst and Young 1989).

As stated above, people from different organisations may work together and form *associations* that extend beyond organisational boundaries and are often seen as being external to the organisation. Some of these are known as value-adding partnerships that might be referred to as communities. Others may be collections of individuals representing their different institutions. In particular, the ability to access resources of different geographically distributed organisations and exchange learning material has been a driving force behind the creation of institutional linkages. The existence of electronic communications technologies has facilitated the creation of institutional linkages as well as opened up possibilities for collaboration and coordination of their joint initiatives (Bellman *et al.* 1993, Mason 1993).

There are a number of *societal* implications of human networks and the use of electronic communication networks. Some writers envisage a shift in competitive pressures facing the global economy while at the same time they propose questions as to the nature of

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these links and their impact on national sovereignty (Hamelink 1984, 1985). The strongly perceived need for a global communication infrastructure (e.g. information highways) has given rise to a new political agenda that has to address issues of who will take responsibility for such development, issues of regulation and maintenance (Kapor 1993, Branscomb 1993). The emergence of these networks brings forth additional fears of social strife in countries where the network is reaching the remotest of people and giving them access to the latest information (Frederick 1993). Issues such as regional integration, the impact of political, social as well as economic conditions on the performance and indeed the very existence of the networks come into play (Quarterman 1993).

An example that we use to illustrate these five levels is the London Stock Exchange. At the first level, the Stock Exchange is very much a mesh of interrelated computers linked by computer networks, telecommunications networks and, in parts, even optical fibres and satellite. At the second level of networking, the working links begin to emerge in the form of networks of market makers, and various traders dependent upon the information technology to carry out their work. Taking this process further up a level, one finds that from the perspective of an organisation, the identity of the Stock Exchange is no longer defined by the trading floor or the building within which much of the transactions used to take place prior to Big Bang in 1986. Now, the organisation is defined through the services that it provides and in particular the information that it controls through the electronic media at its disposal. From an associational perspective, one finds that this is not an isolated organisation, but a network of organisations linked together to perform the various functions of a capital market; a medley of insurance and legal firms, banks and software houses include themselves in this. On the Societal level, the London Stock exchange can also be considered to be an electronic market that underpins a capitalist economy, and is increasingly fraught with pressures to remain competitive in the world economy. According to the tenets of capitalism, the London Stock Exchange is an instrument of the free market economy, upholding free trade and competition. Operating in the increasingly open European and World market means that it has to have to the

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resilience to meet the fluctuating volumes of capital investment.

Consideration of any network at each of these levels requires different approaches and brings forth a number of distinct issues. The issues arising from a level two perspective (work process) of networking are to an extent emergent properties that arise from the infrastructure in place at the first level of networking. Each level is an outgrowth of the previous level and brings forth a new dimension of interactions and emergent properties. In view of this, the categorisation of networks into five layers appears to provide an appropriate and a practical means of addressing the salient features of the network and the issues that arise. In highlighting the characteristics of networking and the main issues that emanate, a possible route for the investigation of networking is determined and used as a guide for the analysis of this phenomenon. This is provided in a more detailed description of the levels of networking presented in the following sections.

Perspectives on Networking

Networking 1: Technology

The first level is characterised by the technology of networking. Exploring networks from this dimension involves the identification of computer networks. A computer network is defined by Tannenbaum (1981) to mean an *interconnected collection of autonomous computers*. This mainly involves the use of electronic telecommunication equipment for setting up communication links. The equipment may be a simple local area network connecting PCs together or it may include a file server containing user files and associated applications software accessed by a number of less powerful computers. In this sense, the above definition of computer networks encompasses distributed database technology. On a larger scale, a wide area network may be used to connect several geographically dispersed sites. This type of network allows the on line transfer of data, usually in the form of electronic mail or in the form of data files held on a remote mainframe or minicomputer site.

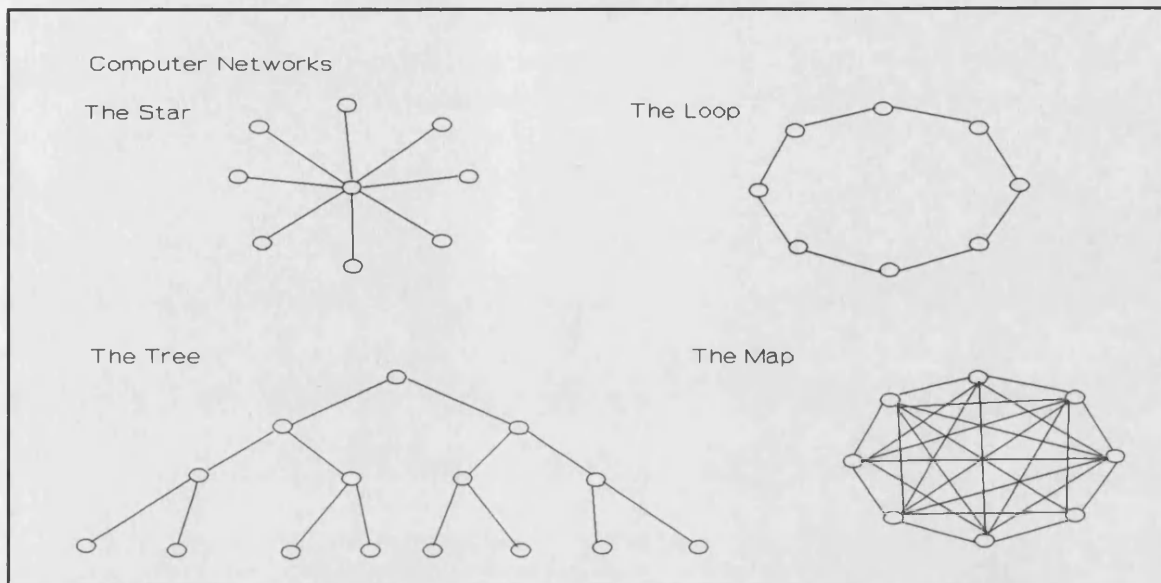


Figure 2: Technology

Evolving worldwide communication networks

Worldwide electronic communications have to a great degree evolved out of ARPANET (1969-1990), a US Defense research Projects Agency initiative, in which resource sharing developed among computers linked by a multi-site packet-switched network. This approach influenced the naming of network components: computers on the network connecting to users were called hosts, because people could log on to them as guests (Quarterman 1993). This technology soon developed services of File Transfer Protocol (FTP), TELNET (remote login) and a simple Mail Transfer Protocol (SMTP) which became very popular and caused the rapid spread of ARPANET. While ARPANET was spreading all over the USA, local area networks were being invented. As electronic networking began to look like interconnected sets of dissimilar networks (such as ethernets) connected by slower wide area networks of ARPANET-Like technology, the Internet Protocol (IP) was invented. IP permits the building of networks of networks using the TCP/IP protocol suite. This meant that ARPANET effectively split into two wide area backbone networks (one for research and the other for operational use) connecting local area networks into what has become known as the Internet. The growth of the Internet was spurred on by the commercial release of the UNIX operating system

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in 1983 and the availability of hardware technology that allowed faster, smaller, and cheaper computers to spread (Quarterman 1993).

Academic networks

The rise of the large academic networks received a further boost as a result of proposals in the USA for a national supercomputer access network by the National Science Foundation in 1984. The NSFNET backbone was thus implemented to use T1 (1.544 Mbps) links in 1987. With the burgeoning volume of data traffic, the main links were upgraded to T3 (45 Mbps) links. These links were then extended to other continents by way of leased lines; to the UK by way of the University of London Computer Centre (ULCC) which then acts a gateway for the European academic network, EARN. Network computing in the 1990s according to Tesler (1991) has become much easier to use. Given the prolific growth of electronic networks all over the world, there is at present no sensible account of how many networks and host computers exist on the Internet. One may question to what extent these information highways are susceptible to breaches of security (Kirby and Murray 1993). It has been estimated that in January 1992 the Internet had about four million users, and by August 1992, the Internet had about one million hosts and five to ten million users (Partridge 1991).

The above electronic communications infrastructure is the backbone to which any institution wanting to be connected to the Internet has to link up. For example, India and South Africa have 64kbps connections to the USA. Both these connections are enabled by way of leased lines provided by their local Packet Data Network (PDN) providers (ie national Telecom companies). Internet host institutions in India and South Africa are in a position to provide other institutions in their respective geographic localities with connections to the Internet. Despite the rapid uncontrolled diffusion of electronic networks, networks at this level are relatively formal and designed entities. Their components easily lend themselves to structured systems development activities. The main criteria for success of an information system being implemented in this layer, as suggested in Kent (1993), are those of robustness, integrity, and security.

Networking 2: Work Process

Work processes, including group formation, are a characteristic of organisational structures that fall within this dimension of networking. Approaches to this level have evolved from the Taylorist ethos of job shops (Jaques 1976, Crozier 1964) towards a more socio-technical style (Trist 1982) involving participation and team building processes. The work process has become increasingly disparate requiring a variety of skills and expertise. The need to obtain information has taken various guises; it is not only necessary to know where to get certain pieces of information but also how to go about obtaining it. Often networks of contacts are a major component of a successful work process as they require inputs from a variety of sources. When relevant expertise is not available then the sources of information and expertise have to be accessed, and contacts with people through networks of people who are knowledgeable about certain activities or know of who can be of help are essential.

Team building

The development of multidisciplinary teams with members that represent a variety of skills, backgrounds and vocations is becoming common practice among organisations. In its Project 1990, British Petroleum reorganised its entire head office into teams comprising a mix of skills and experts from its previous departments. Although this form of organising work is becoming common in project based companies, particularly in the software industry, it is also penetrating into the more traditional organisations such as the Commonwealth Secretariat. Emphasis on teamwork and joint projects is presenting itself as a necessary formula for getting tasks accomplished in the most appropriate manner. This changing nature of the work process is reflected in small-scale increasingly specialised units that require more information to coordinate widely dispersed activities. Team building is a characteristic of this view of networking. Interpersonal interactions increasingly become part of the work process, even if not necessarily part of the formal structure, and work carried out in teams is not always reflected in job definitions or performance criteria. Networks of this form arise as a result of the development of working relations that require the use of contacts over time among people with common

interests and particular expertise. It is difficult to illustrate the formation of these links in a single diagram, however, it is possible to visualise links between individuals belonging to different work groups; this is illustrated in figure 3.

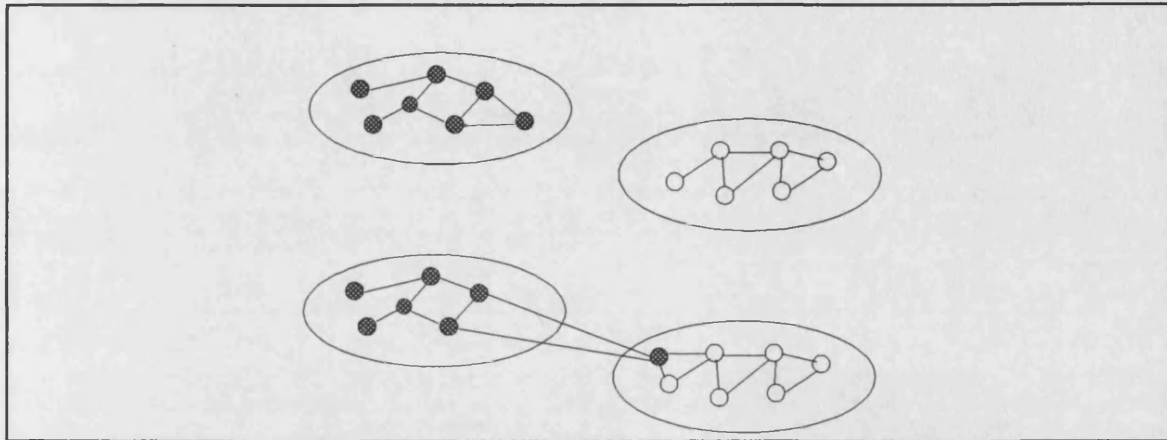


Figure 3: Teams

Movement of a single member from one work group to another brings about a transfer of the links that the member has with those in a previous group and the formation of new working links with members of the new team. Often such links are informal, but they may have a significant impact on productivity and decision making. It is because of this impact that computer networks are being applied in attempts to strengthen or enable these links, but not necessarily to formalise them. The uptake of computer networking reflects the fact that the strengthening of interpersonal links is becoming seen as a necessity because, among other things, it speeds up the transfer and access of information between the different parts of an organisation.

Computer support for group processes

Group processes have been identified as being one of the main factors contributing to the development of networks in the work place. Kanter (1988) refers to group processes as integrating devices that enable the organisation to maintain a degree of cohesion among its many dispersed departments. Electronic support for facilitating group processes may be generally termed as Group Support Systems (GSS). Some of these have

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been used to structure face to face meetings using electronic brainstorming, topic commenter, idea organisation, and voting facilities (Bostrom and Anson 1992). In some GSS ideas and comments generated by the participants appear together on one screen without the identity of the source of the comments ever being disclosed. In providing anonymity to the members' comments in a face to face discussion, and facilitating the problem solving process, proponents of GSS argue that the outcome of these meetings result in better quality decisions (Dennis *et al.* 1988). Although there has been a great deal of research into the areas in which GSS may be effectively used, DeSanctis and Gallupe (1987) state that there are situations in which GSS technology, especially in its current state, may not help. For example, this suggests that simple tasks requiring two or three people may be accomplished more effectively in a regular setting.

The support of work processes in which people do not physically meet or see each other can be provided within *virtual structures* through Computer Mediated Communications Systems (CMCS). As defined by Hiltz and Turoff (1992), "these systems use computers and telecommunications networks to store, deliver, regulate and process communication among the group members and between the computer and the group". Although the most common form of CMCS is electronic mail, other computerised conferencing and bulletin board software is classified under this heading. This medium of communication has been supporting very large scientific and professional communities for some time, but is increasingly seen in different types of work setting. Communication through the computer network can provide a powerful means of linking a group of widely separated people. A popular example of this is co-authoring among geographically separated people who are able to write a report together by using electronic communications technology. Because the text is kept on line, all the authors have access to current versions and when an author makes a change the others secure it immediately. In this sense the use of computer networks has opened up a myriad of possibilities to enhance interpersonal communication and cooperation and made possible a new form of work process.

It is the work process, group projects and the existence of multi-functional, multi-location

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teams and the accessibility of remote experts that brings about interpersonal communication, cooperation and exchange of knowledge. CMCS technologies, in particular, email have been active in facilitating the informal diffusion and dissemination of information throughout organisations and some argue that this brings about more egalitarian beliefs and aspirations (Clement 1994, Schuler 1994). While GSS technologies have been instrumental in refining formal group processes, it may at times also reproduce hierarchical relationships (Perin 1991). In designing and implementing information systems at this level it is essential to consider the above factors and their impact on the relationships among the actors involved in the work processes being investigated. The social processes that occur as a result of and take place on the electronic communication media have to be perceived as they affect the development of patterns of relations and the behaviour of social actors. In addition, more practical issues of motivation, reward mechanisms, and task orientation verses decision making abilities have to be considered.

Networking 3: Organisation

At this level, we investigate networks that serve the needs of and have an influence upon organisation. In order to find out the extent to which a form of organisation can be considered to have networking capabilities, we will draw upon the characteristics of the network form as described by popular writers such as Charan (1991), Coulson-Thomas (1988), Drucker (1988), and Rockart and Malone (1991). Organisations viewed in this way tend to exhibit group processes that operate in parallel to and as part of formal structures of coordination and control. An organisation in which people are able to grasp new concepts and ideas and are able to implement them appropriately befit this view well. It has been found that when people work in groups, an increase in organisational learning is brought about (Argyris 1980). The sharing of information through computerised management information systems, electronic mail and video conferencing are becoming increasingly indicative of this form of networking. In addition, outsourcing, the use of consultants and the diversification and distribution of decision making processes contribute to the organisation's flexibility, dynamism and overall ability to

reposition itself.

Networks within organisations

Organisations have networks as part of their structure. Characteristics of networking may be found in organisations that have to operate in the global marketplace. According to Eccles *et al.* (1993), in the information-rich global marketplace, organisations designed to control and channel information on a strictly hierarchical basis cannot compete effectively. They explain that there have emerged ancillary forms of organisation that are able to capitalise better on information technology. These ancillary forms have become dominant in key areas of decision making such as new product development, major capital investment and responses to major competitive threats. Eccles *et al.* state that (in Bradley *et al.* 1993, p.62):

Analysis of these ancillary forms of organisation led us to characterise them as emerging networks, enabled by capabilities of modern information technology. These networks can be thought of as groups of workers (within as well as outside the formal organisation) that employ a wide variety of information technologies to facilitate frequent, fast, robust communication towards a common purpose. Networks are less stable and more organic than functional hierarchies; during the process of accomplishing a shared purpose, workers in the network may change, and once a shared purpose is achieved, the network may be disbanded. New networks are regularly and instantaneously formed.

Networks within organisations are seen to depend upon a strong information technology capability to bind the organisation together through shared information and appropriate controls. Such ancillary forms which enable an organisation to bring together people from different departments are also referred to as integrating mechanisms (Lawrence and Lorsch 1967). Mechanisms to integrate the various parts of the organisation also play an important role in developing network structures within organisations. Integrating

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mechanisms may include specialised departments or ad hoc teams but, factors such as leadership, interpersonal communication, and commitment also have a profound impact (Kanter 1983). According to writers on organisation, (Etzioni 1961, Schein 1985) the culture of an organisation is its accepted codes of conduct and the extent to which the people within it identify themselves collectively with the ethos of the institution. Culture defined in this way also contributes to the formation of networks within organisations.

The network form of organisation

Although a network may be found in any form of organisation in which there is some form of communication between people, it has also been defined as a distinct form of organisation (Depster and Rooney 1991). The concept of the network form of organisation has been particularly popular with management writers (Drucker 1988, Rockart and Malone 1991, Coulson-Thomas 1988 to name a few) for its potential to build the truly flexible organisation with the ability to meet the challenges of a changing environment. A network in this respect is often thought of as a flat organisational form with one leader and many followers interconnected in many vertical and horizontal communication relations. This network structure reflects the need to facilitate flows of information, power, confidence and trust between members. It is the outcome of an active redevelopment of decision making responsibilities, a redefinition of job descriptions, and the existence of a formal structure that acknowledges complex ties and discourages segmentalist over identification with one area or divisive polarising politics.

A network structure may be seen as a largely team-based structure which exhibits patterns of behaviour that are suited to generating rapid responses to an increasingly demanding environment. The value of this structure is that it gives an organisation the potential to maximise its strengths without being constrained by rigid reporting structures and outdated bureaucratic processes. The achievement of this potential is dependent upon the existence of professional groups of people across the organisation formulating close, informal ties (Drucker 1988). A characteristic of networking within organisations is that the very fluid and often flat reporting procedures can be depicted as a networked

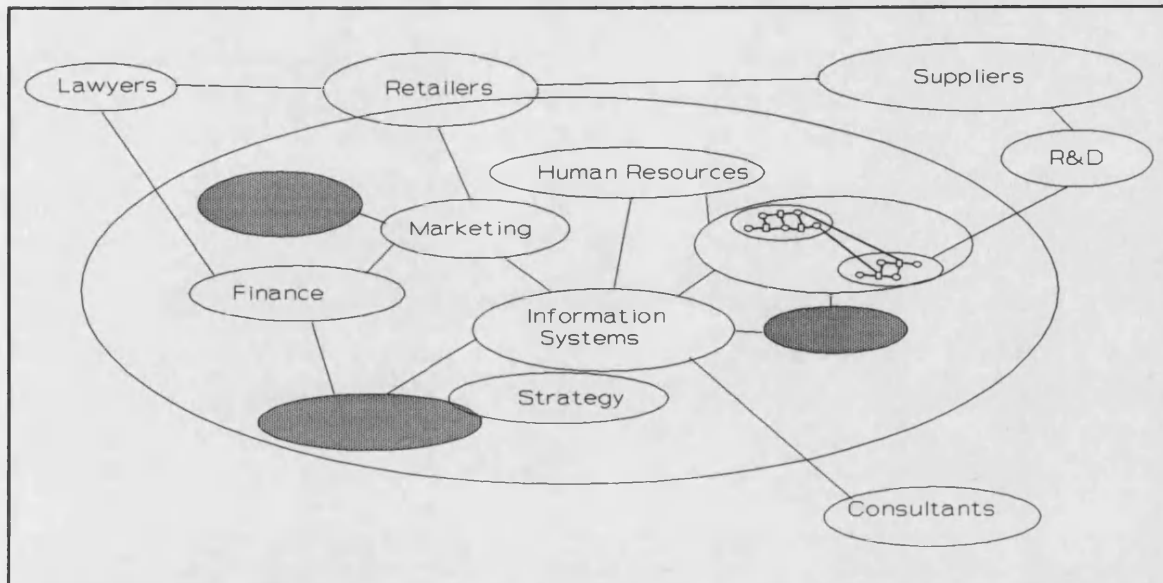


Figure 4: Organisation

egg-shaped structure. This has evolved from the customary functional structure to a more fluid one where the flow of information between the functional areas is smoother. In such a structure there is a heterogeneous distribution of skill in the teams and there is a high degree of decentralisation of decision making.

The network symbolises the image of the flexible, organic form of organisation that has an adaptability to external change and is itself constantly in the process of restructuring itself. The development of working relationships and sets of relatively stable contacts among groups and individuals are seen to be the essential ingredients with which such a versatile organisation may come into being. Drucker gives us the example of the symphony orchestra which operates in synchrony with every individual playing their own specialised piece incorporated into a harmonious performance under the leadership of a single person. Another example he gives is of the administrative structure of the British Empire in India in the 19th century, when a handful of civil servants controlled a mass population on the basis of flexible and quite informal information exchange. Communication among these few civil servants was an essential factor in coordinating the diverse and widely dispersed activities of the government (Drucker 1988).

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Organisations that have joined the bandwagon of the trendy structure have found themselves imitating a new reality, a process that has always been in existence, but now has accelerated due to the catalytic affect of information technology and its penetration into an ever wider range of activities. Issues of job security, definition of roles and responsibilities appear to be more difficult to overcome and there is often a very high turnover of employees (Kanter 1983). This at a time when, an overriding concern of modern organisations is how to maintain the knowledge base that has developed over the life of the organisation (Drucker 1988, Kanter 1983). Technologies such as distributed databases, are of limited value unless their development and maintenance is combined with an appropriate degree of knowledge sharing that takes place within organisations of this view.

Networking 4: Association

The above three forms of networking focus on the internal structures of the organisation and how these may be identified and understood. The associational view of networking focuses on the links that develop in between organisations, people and often even groups of people and organisations. The physical existence of an association is formed by a series of working links among people and/or organisations (actors). The identity of an association is formed as a result of the combined effort of the actors. Structures of work processes and organisations viewed at this level may be identified in a market where buyers and sellers come together to trade goods and services. Dealing in stocks and shares at the Stock Exchange is enabled, facilitate and monitored electronically. Some airline reservation and holiday booking systems have made the organisations administering these systems behave like marketplaces bringing together suppliers and relevant clients.

Information and strategic alliances

In addition, it has been suggested that companies that establish a comprehensive information base for their internal use may also develop the information as a product (Porter and Millar 1985). These organisations develop strategic alliances among smaller

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firms to compete successfully against larger ones (Ernst and Young 1989) and function as networks of a range of diverse organisations performing specialised functions. In the fashion industry, for example, it is common to find a number of different firms operating together to produce, market and support products under a trademark seen to belong to a single company.

Furthermore, the physical existence of organisations becomes more of a metaphor than actual entity and their reason for being becomes increasingly dominated by the exigencies of the environment. The London Stock Exchange is an example of such an organisation where dealing in stocks and shares is enabled, facilitated and monitored electronically; its extensive use of computer networks has recast the London Stock Exchange's identity as an electronic marketplace and information supplier. Associations may find themselves functioning as parts of a chain that produces a collection of goods often defined only by a single brand name. The need for strong, efficient communication links between organisations is evidence for the increased specialisation of parts and the increased effort required to coordinate them. Information technology and, in particular, electronic communication networks have made it possible to coordinate activities that are geographically distributed and require inputs from a number of sources.

Inter-organisational linkages

Networking in between organisations brings about new ways of doing business while reconfiguring and at times almost eliminating the boundaries of the organisation. Such organisations rely heavily on communication technologies for their daily operations and survival. At the forefront of these technologies in the commercial world is Electronic Data Interchange (EDI). EDI utilises existing technologies: computing and telecommunications to achieve data communication for general and specific transactions and data interchange (Schatz 1988). Although it is used within organisations it has a greater impact on inter-relationships between them. Finch (1989) has identified three stages of integration: 1) There is no change in the way business is carried out, 2) Customers and suppliers begin to forge close long term ties and the relationship is more

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cooperative, 3) The nature of the business changes through the use of EDI causing the role of the organisation to change completely and in an unpredictable way. In investigating information systems within the associational view, it is necessary to ensure that the appropriate stage of EDI integration has been established. Just-in-time techniques fall into the second stage of EDI integration whereas electronic funds transfer and trading systems are part of the third stage (in Rose 1989). Increased cohesion within organisational units and the strong coupling in between them can be seen in a number of arenas. In particular, the rise of the value-added partnership (Konsynski and McFarlan 1990) has its ramifications for the production of goods. For example, the software industry bears witness to the fact that the programming skills of the South East Asian workforce is used for the production of large applications that are marketed by companies in Europe and the USA.

At this level of networking, the formation of links among organisations is about the sharing and exchange of resources in attaining joint objectives. In investigating networks from this perspective it is worth identifying linkages among people and organisations and the types of resources that are exchanged and, most importantly the nature of the joint objective. In addition, collective learning processes among organisations arise as a result of this impetus to be part of an influential and resourceful group. The ability of networking at this level to foster the development of close ties, the sharing of knowledge and expertise needs to be observed within the context of the type of associations that occur. Finally, the nature of the association, its function, purpose and role in the face of long term realities has to be considered.

Networking 5: Society

When considering issues of networking at this level, it is necessary to consider the broader issues relating to the increased specialisation of the world economy which has led to the use of communication technologies to facilitate trade, the transfer of funds and information throughout the world. These do not fall under the jurisdiction of any one organisation or country. The transnationalisation of enterprises has lead to new

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structures. They can hardly be seen to function as simple organisations as they wield power in setting patterns, forming attitudes and motivating behaviour which is comparable to that of a government, and sometimes (because of the financial resources committed) even greater (Mc Bride 1980). Access to a wider range of resources is a prime concern. Increasingly the resources that must be shared over a widely distributed range people, are to do with information in the form of publications, comments, research and new product details. Gillespie and Hepworth (1988, p.1) state that:

New Information technology and information, as a tradeable commodity, are at the centre of structural changes in the economy and Society... Telecommunication plays a crucial role in spatially integrating the information economy, permitting a new division of labour and new patterns of regional and economic specialisation.

They add that the role of telecommunication in regional development must be reconceptualised, given that computer networks are mediating a large and growing share of both market and non market transactions in the information economy. To do this, it is necessary to consider crucial ownership and control differences between public and private networks. Although new types of public data networks have been established (packet switching) most networks are proprietary systems - available only to an authorised group of end users or a club of member companies. The electronic highways of the information society are not public thoroughfares but are more akin to a myriad of private roads in which telecommunication channels are not simply intercity systems for transporting information, but are integral components of network based production, distribution and managerial processes in firms (Gillespie and Hepworth 1988).

These comments allude to the rise of the information economy fuelled by the volume of the information it produces and transports. Operating on a global scale, this economy is giving rise to products and services for computer networks, ranging from shopping to legal and administrative. These are described in Negroponte (1991). As is the case in a

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free market economy such as the USA, competition among suppliers is also heating up as described in the Newsweek (Meyer 1994). In this, the provision of electronic communication infrastructures is being supported by some governments particularly the US, France and Singapore to name just a few. Support of the US government dates as far back as 1945 with the report of Vannevar Bush (President Roosevelt's Science Advisor) which was the foundation for the development of the Internet (Chapman 1994). More recently, the Clinton administration sees this infrastructure as making "a difference in the lives of the American people, to harness technology so that it improves the quality of our lives and the economic strength of our nation" (Clinton and Gore 1993). Similarly, the Singapore government aims to strengthen its economy through the development of its electronic communications infrastructure. In summary, it appears that the distribution of wealth and political power in the world, environmental sustainability, and the quality of life are all at the heart of politics and democratic civic culture (Chapman 1994).

However, one may ask whether these well meaning intentions really strengthen the economic power of a nation by fostering a democratic civic culture or do they in effect force groups of people, and nations to comply to a politically charged technology that may be seen to support 'old' power structures. In the last decade there has emerged a global community referred to as the *global civil society* (Frederick 1993, Hamelink 1991). The concept of civil society proposes that human society should be defended against the power of the state and the inequalities of the marketplace. According to Cees Hamelink (1991) the emergence of the global civil society is articulated by the Non-Governmental Organisation movement. Frederick (1993) explains that a metanetwork of highly decentralised technologies - computers, fax machines, amateur radio, packet data satellites, and VCRs has arisen. Within this framework, the Association for Progressive Communications (APC) was instrumental in the creating electronic networks such as PeaceNet in 1984 (the world's first network dedicated to serving movements of peace,

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human rights and social justice)¹ Supported by the APC, some NGOs are able to minimise their use of national communication infrastructures and are seen to be relatively independent of government control. Despite the supposed emergence of electronic communications as a vehicle for the nourishment of the global civil society, there are as yet no legal provisions for civil liberties in cyberspace or even legislation to ensure the security of public information highways from hackers (Branscomb 1993). The US government (the FBI) has been known to tap electronic mail communication to detect traces of computer crime. At the same many feel that if nothing is done to protect the citizen's electronic communications privacy, the use of electronic media will become a privilege, rather than a right (Kapor 1991)².

Structure of this Dissertation

This dissertation investigates the network concept in the light of the information systems research tradition. Networking is considered to be a process in which the structure of human networks readjusts itself to changing circumstances. The characteristics that might distinguish the network form are set out in terms of the use of technology, work process, traditional organisational functions and also considers associational and societal perspectives. Using the layers of networking as a starting point for the analysis of this phenomenon, this dissertation presents an interpretivist research strategy which is developed in Chapter Two, *Methodology and Research Approach*.

In Chapter Three, *Organisational Perspectives*, the research proceeds to trace the evolution of modern models of organisation together with the contemporary perspectives

¹ In 1987, the Institute for Global Communications was formed and now constitutes PeaceNet, EcoNet (dedicated to advance the cause of planetary, environmental protection and sustainability) and ConflictNet (dedicated to serving non-violent conflict resolution, dispute mediation and arbitration).

² A recent newsweek article made a plea to keep the "Cybercops out of Cyberspace" (Meyer and Glick 1994). At the same time, Mitchell Kapor (1991) gives us the example of an electronic game publisher whose hardware, a bulletin board on which he conducted his business and private email system, were seized by the authorities for over a month thereby paralysing his business. In the end, the publisher was acquitted and his property returned but the damage to his business was done.

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on information systems. It considers the relevance of these perspectives to the rise of new and emergent organisational forms characterised as networks and presents an analysis of the underlying themes that motivate such developments. The need to look beyond organisations and into a more loosely defined perspective is identified.

In Chapter Four, *Tools and Techniques for Exploring Social Structures*, a social science perspective of structuration theory and social network analysis (also known as structural analysis) are introduced. Theoretical tools developed using concepts from social network analysis, are illustrated. It guides the researcher in how to go about examining and representing network structures.

In Chapter Five, *A Case Study of the Commonwealth Network of Information Technology for Development (COMNET-IT)* is described. This is a network of people and organisations involved in joint activities. The focus of COMNET-IT activities is to add value to the work of a group of geographically dispersed experts within Commonwealth countries. The resulting activities are initiated and pursued within different task forces as networking projects coordinated by COMNET-IT. In particular, two networks that have spawned out of COMNET-IT are described further to bring out aspects of networking. Aspects of networking in the case study are then interpreted and compared with other initiatives within the five layers of networking.

In Chapter Six, *The Dynamics of COMNET-IT*, the data collected from electronic steering group meetings is analyzed using the tools and techniques drawn from social network analysis. The study explains observed interactions between human actors and the development of patterns of relations. An empirical analysis of behaviours on the electronic social space enable features of networking to be extracted. This data is used to provide evidence of network structure and the way in which it functions. Using the levels approach, generalisable properties of networks that emerge from the empirical analysis are presented in the context of other studies.

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Finally, Chapter Seven, *Insights into Networking*, pulls this research together by first summarising the dissertation. It then synthesizes the contributions of this thesis and facts uncovered into a set of practical insights that need to be considered in order to effectively support network processes. Based on these insights, the approach of this research is evaluated and directions for future research proposed.

It's clear that we can investigate the things in space - but space itself !

Ludwig Wittgenstein

Chapter 2:

Methodology and Research Approach

Chapter Two: Methodology and Research Approach

Introduction

In this chapter a research strategy for the investigation of networking is developed. This chapter begins by describing contemporary perspectives in information systems research. It then discusses the case study method chosen here and the role of the researcher within it. The approach of levels is set out and developed further into sets of questions that are intended to guide interpretation of the description of the case study. The chapter then outlines the guiding themes and procedures that are used to analyze the data obtained and to explain the potential for generalisation from this research approach.

Electronic networks have brought about a change in the nature of how work is carried out. Patterns of interpersonal contacts and communication relations have become a powerful force in changing the ways in which work is organised. A single activity can now be performed by people who may not be located near each other. In a situation such as this, traditional authority structures can no longer take effect through well-defined roles and responsibilities. Further, the boundaries of a task may transcend organisations and indeed countries. The increased differentiation brings about the need for more communication and coordination. In this sense, it may be more appropriate to describe the work process as combined human action defined by legitimised sets of human values, norms, rules and regulations (Giddens 1984) rather than organisational reporting structures. The extent to which the traditional organisational paradigm affords an understanding or approach to human networks, is limited by its focus on formal reporting structures.

In this light, information systems research requires a greater understanding of the contextual factors that affect the development and use of information (Walsham 1993, Madon 1991, Pettigrew 1985). Ensuring that systems are robust and functionally sound does not automatically guarantee that they will be used appropriately, and in the ways in which they are intended to be used (Angell and Smithson 1991). While the information systems perspective is attempting to gain an understanding of social processes affecting information systems development and use, it is still very largely

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engaged in the process of struggling with the need to develop technically sound systems within given organisational contexts. This research however, attempts to go further and to address the need for a more appropriate means for investigating networks in terms of patterns of relations and behaviour. For this a social science perspective is potentially more appropriate in enabling us to obtain an understanding of the processes that give rise to these patterns of behaviour.

Perspectives in Information Systems Research

Research in information systems appears to be widely applicable in that it is based on a variety of perspectives that employ a diverse range of research methods. The ontology, or assumptions made about the phenomena being investigated, seen in contemporary perspectives on information systems research have been described by Iivari (1991) as follows:

I. *The view of information/data* as descriptive facts and constitutive meanings, or objectivistic (data model reflects reality) and subjectivistic (data model is a construct of reality) interpretations of the universe of discourse.

II. *The view of information/data system* as social systems only technically implemented. A tool perspective reflects a technical/mechanistic view of an information system, whereas the institutional view emphasizes the social nature of information systems.

III. *The view of human beings* from deterministic or voluntaristic perspectives. In drawing upon the theories of motivation, information systems research may take a deterministic view that regards human beings and their actions as being completely determined by the environment in which they are located. Alternatively a voluntaristic view may be taken in which human beings are seen as completely autonomous and free-willed.

IV. *The view of technology* makes a distinction between technological determinism and human choice. Technological determinism implies that technology develops according to its own laws and is relatively inflexible. Human choice emphasises the flexibility of

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technology, the possibility of people controlling it, and their responsibility for its development and consequences.

V. The view of organisations and society is based on the distinction between structuralism and interactionism. Structuralism focuses on organisational structures, which are likened to a slowly adapting social reality. Interactionism views organisations as arenas in which people enact important meanings and uses a political perspective to view organisations as battlegrounds in which participants continually struggle for control over valuable resources.

Iivari (1991) states that the contemporary schools of IS development correspond to orthodox, functionalistic ones. Of the schools studied by Iivari, the prevailing assumption was found to be dominated by the view of information/data as descriptive facts. He suggests that a structural view of organisations, a means/end oriented view of IS science and a positivistic epistemology prevail. This general finding is supported by Orlikowski and Baroudi (1991) who suggest in their study that 96.8% of research in the leading information systems journals follows the positivist tradition. The ontological basis of the positivist research tradition is that there is an objective physical and social reality that exists independently of humans and that the nature of reality can be relatively easily understood, characterised and measured. Organisations are then understood to have a structure and reality beyond the actions of their members. In other words, positivism seeks to "explain and predict what happens in the social world by searching for regularities, causal relationships between its constituent elements" (Burrell and Morgan 1979).

In this positivist tradition, the role of the IS researcher is to discover the objective physical and social reality by using modelling and measurement to build an appropriate set of constructs and an accurate set of instruments to capture the essence of the phenomenon being investigated. A one to one correspondence is assumed between the constructs of a model and the events, objects, or features of interest in the world. The researcher is seen to play a passive neutral role and does not intervene in the

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phenomenon of interest. An example provided by Orlikowski and Baroudi (1991), is researchers investigating the relationship between information technology and organisational structure, assuming structure to be objective and hence capable of being represented by a number of researcher-devised constructs and measures such as: span of control, division of labour, centralisation, formalisation and hierarchical levels.

The opposite anti-positivism, as described by Burrell and Morgan (1979), maintains that the social world "can only be understood from the point of view of the individuals who are directly involved in the activities that are to be studied". Anti-positivist researchers maintain that in order to understand human activities the researcher has to occupy the frame of reference of the participant in action. It is necessary to understand from the inside rather than the outside. Anti-positivism emphasizes human interpretation and understanding as constituents of scientific knowledge. Within anti-positivism lies the interpretivist research tradition. The ontological basis of the interpretive research tradition is that there is no objective account of events and situations. Social reality lies inside the minds of human actors and is created as a result of collective human action. Interpretive studies were found to comprise only 3.2% of the research sampled by Orlikowski and Baroudi (1991). The criteria they adopted in classifying interpretive studies were evidence of a non-deterministic perspective where the intent of the research was to increase understanding of the phenomenon within cultural and contextual situations; where the phenomenon of interest was examined in its natural setting and from the perspective of participants; and where researchers did not impose their outsiders' *a priori* understanding of the situation.

On the basis of this data, it appears that information systems research is dominated by positivist research with a prevailing set of assumptions about what constitutes acceptable information systems research. The purpose of information systems research in this context is to serve as a vehicle for enabling the appropriate implementation of information systems within organisations. Having its roots in the field of business administration and management practise has meant that information systems research has been expected to produce approaches to IS development that are conducive towards

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providing IS solutions to organisational problems.

In his study of contemporary information systems research methods, Iivari (1991) goes on to distinguish between three categories of research which he describes as follows:

I. Constructive research methods

- *conceptual development*
- *technical development*

II. Nomothetic research methods

- *formal-mathematical analysis*
- *experiments (laboratory and field experiments)*
- *field studies and surveys*

III. Idiographic research methods

- *case studies*
- *action research*

Iivari (1991) describes conceptual development as the "development of various models and frameworks which do not describe any existing reality but rather help create a new one and which do not have any physical realisation". IS development methodologies are given as an example of such conceptual development. Technical development according to Iivari (1991) produces physical artifacts or executable software, such as CASE environments.

Nomothetic methods emphasise the "importance of basing research upon systematic protocol and technique, and focus on the process of testing hypotheses in accordance with the canons of scientific rigor" (Burrell and Morgan 1979 p.6). Information systems research that is based on nomothetic research methods involves the development of scientific tests, qualitative data analysis techniques, surveys, questionnaires and other standardised research instruments employed in controlled laboratory experiments

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investigating groups using GSS for example.

Idiographic research methods emphasise the analysis of subjective accounts that are generated by getting inside situations and involving oneself in the everyday flow of life. The idiographic method stresses the importance of letting one's subject unfold its nature and characteristics during the process of investigation (Burrell and Morgan 1979). A conceptual model used by Checkland (1981) in this way is a representation of reality as perceived by the model builder and serves as a formal vehicle for debate about change. According to Orlikowski and Baroudi (1991), the research methods appropriate to generating valid interpretive knowledge are case and field studies as they examine human actors within their social settings.

Although nomothetic methods might be seen as corresponding to the positivistic epistemology, and idiographic methods to the anti-positivistic, they have been used interchangeably; thus case studies can be used in the positivistic sense of generating and testing hypotheses, but action research is seen to fall exclusively within the domain of an interpretivist research strategy (Iivari 1991).

The Case Study

This research employs the case study in an anti-positivistic, interpretivist way in order to produce an in depth description of a real world situation. The current literature on case study research is very varied and often conflicting. This section describes the main issues prevailing in case study research, highlighting strengths, weaknesses and observations. A review of the literature suggests that the case study has been used as part of an interpretivist research strategy, a positivist research strategy or a mixture of both. This type of research has been employed in so many different settings and research strategies. Even so, it is possible to draw upon the experiences of past research in order to come to a relatively good understanding of its limitations and capabilities.

A case study applied in the positivist sense, is used as a means of validating theory in that "it examines a phenomenon in its natural setting, employing multiple methods of

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data collection to gather information from one or a few entities (people, groups or organisations)" (Benbasat *et al.* 1987). In this sense, the case study provides a setting in which the positivist researcher may gather evidence to substantiate or refute a hypothesis or simply to obtain an understanding of certain key variables. In view of this way of using the case study, Benbasat *et al.* (1987) state that the case study may be used as a research methodology which is useful when the research phenomenon is not supported by a strong theoretical base.

Emphasis placed on validating a theory or hypothesis is at the core of a conflict between advocates of case study research and its opponents. The argument is put that it is difficult to distance the resulting representations from the interpretation of and meanings endowed by the researcher. Recognising that there is no one objective reality, Milner and Hughes (reported in Hemel and Dufor 1993) proposed that researchers need to move away from the scientific method and realise that the case study is not appropriate when trying to validate a theory. Hemel and Dufor (1993) add that case study research is not successful as research when the objective of the researcher is to just reconstruct facts, give them meaning within the scope of an existing theory or theoretical framework.

Using a case study within a positivist research approach is contentious. Talcot Parsons' (1960) advocates the traditional view that methods for testing theory should be devoted to scientific virtues. He states that if the case study is to be seen as a research instrument, it should be possible to validate ones' findings. From this perspective, case study research has two very major drawbacks (Hemel and Dufor 1993):

1. *It lacks representativeness and there is often no single observation point.*
2. *It lacks rigor in collection, construction and analysis of empirical material.*

To this, Eisenhardt (1989) responds by suggesting that case study research is especially

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suited to sharpening the constructs from which a theory is built and verifying emergent relations between these constructs. Yin (1989) addresses the above two criticisms (that case study research lacks representativeness and rigor) by advocating that case study research should be carefully designed. A well designed case study strategy, according to Yin, must begin by exploring the phenomenon being investigated. It should then become explanatory by focusing on the salient features identified in the exploratory phase. He adds that in designing a case study strategy, decisions must be made about site selection, determination of sources of evidence and analysis of the case (these are addressed separately further on in this chapter).

Another way of addressing the question of representativeness is to use the case study in conjunction with nomothetic research methods such as field studies and surveys. Field studies and surveys provide a breadth of knowledge about the phenomenon being investigated. They involve the manipulation and measurement of clearly defined variables, and rely upon the researcher's *a priori* knowledge to form the study as well as a host of hidden assumptions for generalisation of results. Field studies and surveys, together with laboratory experimentation, are seen by some as limiting the researcher's understanding of the real world in that, as stated by Galliers (1987) "...the need to apply values to variables often leads to the elimination of factors that, although they may have relevance, are difficult to value." It is often argued that field studies based on samples and questionnaires, destroy the researcher's conception of the social system as an organic whole, thus limiting her/his understanding of the change process (McCall and Simmons 1969).

Using the case study in conjunction with the above can help build up the researcher's *a priori* understanding and provide a better understanding of the real world. In effect, case study research enables the researcher to put into context hidden assumptions and highlight the significance or lack of significance of the variables being investigated. In this way, field studies and surveys are often used as a means of proving or disproving a hypothesis and inferring causal relationships. When using field studies in parallel to case studies, there is consensus that the empirical results of field studies require a description

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of their properties. These properties, sociologists argue, should be defined in the context of the experiences of the social actors and meanings they assign directly to such experiences. In view of this, the case study proves to be "the descriptive study par excellence in depth" (Hemel and Dufor 1993).

From here we can turn to considering the case study within an interpretivist research approach. As a sociological approach, the case study aims to highlight features or attributes of social life. This is true whether social life is perceived as a set of interactions, as common behaviour patterns, or as structures (Hemel and Dufor 1993). It is the depth and the descriptive capabilities of the case study that make it valuable for interpretivist research. The aim of interpretivist research is to explain how members of a social group, through their participation in social processes, enact their particular realities and endow them with meaning, and to show how the meanings, beliefs and intentions of the members help constitute their social action. The final outcome of interpretive research should be an understanding of why people behave in the ways that they do in a particular situation. In interpretivist research, this may be achieved using phenomenology "an approach which sets out to describe the situation being studied" (Galliers 1985) or hermeneutics which is the interpretation of text (Borland 1985).

It is apparent thus far that case study research may be carried out as part of a broader research strategy involving a number of research methods or it may be used in its own right. The approach of this research uses the case study in its own right. A single case study is used in this research as a way of carrying out an in depth investigation of a real world situation using an interpretivist research strategy. The interpretivist researcher cannot look for statistical generalisability - a legacy of positivist research, but must be aware that there is no single all encompassing truth. The generalisability of interpretivist research is about the nature of ideas (as is the case with Giddens' work), of theory and of concepts that may be used to inform action and/or further research. Geoff Walsham illustrates the use of generalisable knowledge with the example of crossing the street. From past experience we know that a driver will not run us over, so when a car comes towards us, we continue to cross the street. Although we may not have been run over yet,

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our theory sensitizes us to the fact that there is the possibility that a driver may run over us. So when we cross the street, we also prepare to jump back on to the footpath in case the driver does not stop.

In short, the generalisability of case study research is in generating a body of experiential knowledge which may be distilled into ideas, theories and concepts that can be used in different settings at different points in time. This may be done by identifying causal relations over a period of time, by presenting a narrative within the context of a theory or framework, by developing or modifying an existing theory or combination of theories in the light of knowledge gained in the case study, or by comparing the knowledge and explanations with other studies. More specifically, as is in the approach of this research, the case study may be used to generate concepts that may apply to other contexts and provide theoretical insights that may be valuable in these contexts. In this, the value of a case study is in generalising partially and describing completely (Walsham 1994).

Action Research and the Role of the Researcher

In addressing the use of case study research in its own right, it is necessary to consider the role of the researcher. In considering the role of the researcher in the context of case study research, it is useful to visualise a continuum. On the one extreme, the researcher may take the role of the outside observer who records observations from an external standpoint. On the opposite extreme is action research where the researcher has an active role in the situation under investigation. In the middle, is participant observation in which the researcher is part of the phenomenon being investigated but does not attempt to influence the change process. This continuum, as illustrated in figure 1 below, is used as the basis of this discussion.

The outside observer characteristically employs well defined data collection techniques such as surveys, questionnaires and various publications. The outside observer is not part of the phenomenon being investigated, and she/he is able to collect analyzable data without entering into the situation under study. The researcher in the role of a participant observer, directly observes and participates in the sense that she/he has

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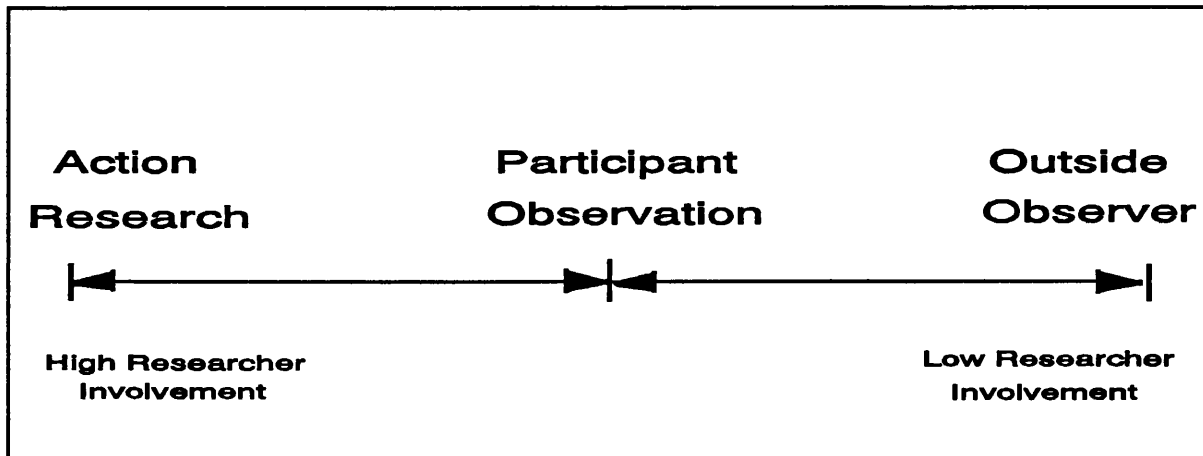


Figure 5: Role of the researcher

"desirable social relations in the social system under investigation" (McCall and Simmons 1969). The participant observer is supposed to be neutral. While the participant observer is part of the phenomenon being investigated, her/his role is directed at obtaining an understanding of the situation based on her/his observations and not to intentionally affect or change the situation. The limitations of participant observation are seen to be in that the researcher depends upon more impressionistic interpretations of data for arriving at generalisations, and that there is the likelihood of the researcher's bias affecting the knowledge gained of the situation. The virtues of participant observation stem from its ability to make effective use of the relationships which the researcher establishes with informants in eliciting data and to collect non-standardised data so that an inquiry can be directed on the basis of incoming data. In addition, participant observation is not bound by the researcher's prejudgment (as is found in field studies) and, based on her/his knowledge of the situation, the participant observer is able to avoid asking meaningless and misleading questions (McCall and Simmons 1969).

Action research, in contrast, gives an explicit role to the researcher to be a part of a change process. This informs her/his actions as well as those of the other participants. Action research is typically carried out as part of an attempt to solve problems by allowing the researcher to become a participant in the action, and the process of change itself becomes the subject of research (Checkland 1981). For action research to be successful, the human activity system being investigated must be conducive to information

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sharing and learning. The action researcher is not alone in gathering data for the research, the other participants are also responsible for data collection. The value of action research is in sharing the data collected and its analysis. The participants share their data with the researcher and the researcher shares theories and knowledge with the participants. This sharing then feeds into a learning process in which the researcher modifies her/his theories and the other participants modify their perceptions and ways of working. Argyris (1982) defines action research to be an inquiry into how people design and implement action in relation to each other. He states that because of this, action research is a science of practice. In a similar way, Zuber-Skerritt (1991, p.10) define the practice of action research by stating that:

Action research is a particular way of critically learning about events in this world in order to change them. It combines theory and practice into a critical process...action research is an experimental, systematic and critical process which involves people working together to improve complex, problematic situations.

In action research, the researcher has a remit for action and action research may be used to support the researcher in an active experimentation process. In this sense, Zuber-Skerritt (1991) describes action research to have the following four main elements: plan, act, observe and reflect. This way of using action research involves a cycle in which the researcher's observations and reflections feed into abstract conceptualisations and some very concrete experiences which together inform the researcher's active experimentation process. This cycle is not a simple, sequential process but one in which the researcher may be cycling between the stages many times, as is illustrated in figure 2.

Action research may also be employed to support participation in problem solving and decision making processes. Writing in the context of Multiview, Avison and Wood-Harper (1990) state that a major theme in action research is that practitioners should participate in the analysis, design and implementation process and contribute at least as much as researchers in any decision making. They add that there is thus synergy between

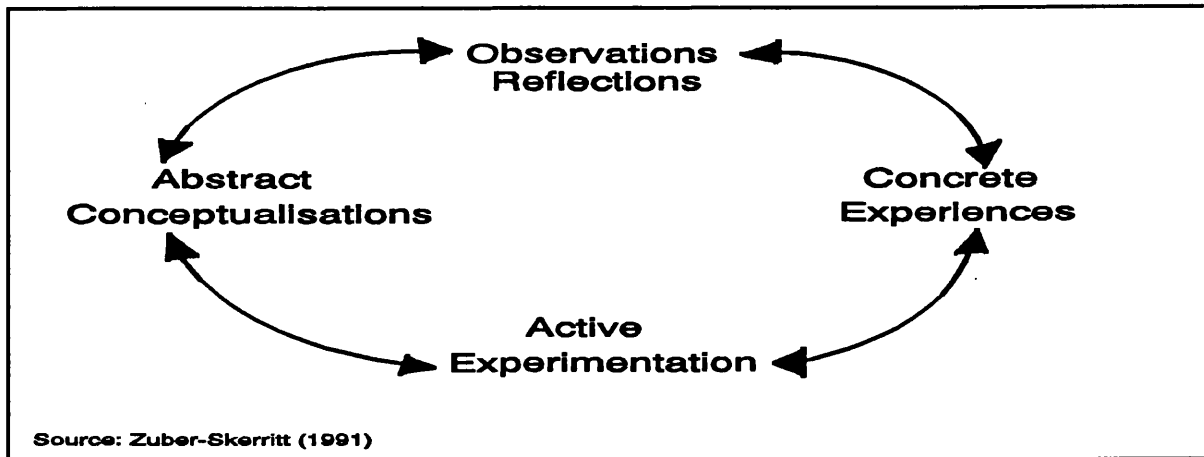


Figure 6: Action Research Cycle

the researchers and practitioners in which the researchers build up theories and modify them on the basis of practical experience and the practitioners use and modify researchers' ideas for solving real world problems. In this way, it is argued, action research is particularly effective in facilitating problem solving mechanisms, group learning, and managing a change process.

According to Checkland (1981), problems with action research arise from the fact that it cannot be wholly planned and directed down particular paths. Where a particular situation does not present a problem situation that is perceived to require change, action research will not be seen as appropriate. At the other end, a weakness of action research, according to Benbasat *et al.* (1987), is that it potentially lacks objectivity stemming from the researcher's stake in effecting a successful outcome for the client organisation. They add that further generalisations to other situations where the intervention technique is applied by people less knowledgeable than the researcher may be difficult.

In view of this, an interpretive role for the researcher becomes apparent. The role of the interpretive researcher is to construct explanations that account for the way in which subjective meanings are created and sustained in a particular setting. This is not captured in hypothetical deductions, covariances, and degrees of freedom. Instead, the researcher is required to be part of the social process being investigated, to develop an understanding of how practices and meanings are formed and the tacit norms shared by

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the human actors working towards a shared goal. Interpretivist research resembles action research in that the researcher may be considered to be a team member. While interpretivist research, like action research, is not planned or directed down a particular path, the researcher develops an understanding of social processes and how meanings are formed and tacit norms are shared. In this sense, the role of the interpretive researcher is to interpret not specify. In general terms, the role of the interpretivist researcher is not interventionist but phenomenological - where the researcher's primary objective is to describe the actors' social reality by observing and interacting with the human actors and construct explanations that account for the behaviour of human actors.

An interpretivist researcher is similar to a participant observer in that they are both part of the phenomenon being investigated and are able collect sensitive data because they are in a position to make use of desirable social relations. They can, as a result, focus on meaningful issues and describe their observations in great depth and detail. The role of the interpretive researcher differs from that of a participant observer in that the interpretivist researcher attempts to include the perspectives of the human actors in developing an understanding of the social system being investigated and does not depend entirely on her/his own impressions for arriving at generalisations. Unlike the participant observer, the interpretivist researcher does not pretend to be neutral and is always implicated in the phenomena being studied. Taken a step further, the interpretivist researcher is not merely presumed to describe a phenomenon in the words and categories of the actors, but enacts the reality she is studying (Orlikowski and Baroudi 1991).

Unlike the action researcher, the interpretivist researcher does not become a participant in action and an explicit change process does not become the subject of the research. The interpretivist researcher collects her/his own data and is under no obligation to share this with the participants or informants. Synergy between research and practice may occur but as an accidental spin-off or a matter of choice. The value of action research is in people working together to improve complex problematic situations whereas the value of interpretivist research is in describing social processes and providing

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explanations for their behaviour. The interpretive researcher arrives at generalisations through her/his participation in these social processes.

Approach of this Research

In this research, the role of the researcher is considered to be interpretivist. In her position as the coordinator of COMNET-IT, the researcher is part of the network project and has access to some very pertinent information: she is able to build her understanding of situations through consultation with people involved in COMNET-IT and people outside of the project. As she is not perceived to be an outsider in the context of COMNET-IT, the risk of a Hawthorn effect prejudicing the responses of participants is seen to be minimal. However, because the researcher is not managing a change process, it is difficult for her to experiment with different ways in which subjective meanings may be created and sustained. For example, in considering how the electronic communication facility supports communication among participants the researcher cannot expect the participants using the system to provide feedback on their experiences with the technology. Because the researcher shares the experience of using the same communication medium as the participants, she is able to describe how this technology is used and construct explanations to account for why certain problems arise. The process of solving these problems is not a collective effort. The value of interpretation over specification in this research enables the researcher to highlight salient features of the network phenomenon and describe the way in which it works.

Because research in the area of networking and the network form is still in its formative stages, there is the need for an approach to address the broader context of the network being investigated and bring out the salient features of networking. An interpretivist approach using the case study provides us with a way of investigating the network phenomenon in considerable depth. This approach is useful in bringing together the very varied and disjointed aspects of networking while at the same time enabling the researcher to consider carefully the network phenomenon as a whole.

The case study strategy of this research is designed in such a way as to provide the

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researcher with sufficient breadth to investigate the different aspects of networking, while at the same time to obtain an in-depth understanding of the situation being investigated. The case study is used to provide a rich description of processes over a period of time. Although the case study is not used in this research as a means of validating a theory or hypothesis, some of Yin's (1984) guidelines for the design of a case study are found to be useful, especially in achieving representativeness and rigor. In order to obtain representativeness, it is necessary to be clear about the domain of investigation. For this, an initial set of questions that set the scene (exploratory) and then guide the direction of the study (explanatory) have been developed. The next step is to define what the case is. This is stated by Yin as unit of analysis, and is related to the way in which the initial research questions are defined and sources of evidence and analysis determined. In this way, rigor is achieved while at the same time the ability to gain an in depth knowledge of the network phenomenon is retained.

The approach of this research parts company from Yin's guidelines when the research strategy progresses towards developing the approach of levels described in chapter one. This approach of levels is then used to build representativeness into the case study strategy and guide the interpretation of observations and results. A set of questions relating to each of the five levels of networking are laid out to aid the researcher in obtaining a breadth of understanding in interpreting the case. This chapter concludes by describing the guiding themes and procedures for analyzing the data obtained.

Research Design

The design of this research strategy accords with the phenomenological tradition of observation and description. The objective is to provide a rich description of the situation while highlighting those aspects of networking that appear to be essential to our interpretation. This study attempts to find out:

How do electronic networks develop, and facilitate human networks ?

What are the key factors that affect the work process and activities

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performed by the different members?

What are the boundaries artificial or otherwise, that define the nature of these activities and who carries them out?

What are the criteria that define the identity of the project as a whole?

What contextual (socio-economic and political) factors affect the functioning of the project as a whole and the separate activities that comprise it?

Having delineated the context of our investigation with the above questions, we proceed towards an exploratory strategy to understand how to frame questions such as:

What are the basic components of communication and information dissemination and diffusion?

Are these elements restricted to what takes place within an organisation or do they transcend accepted organisational boundaries?

Does support for the basic elements of human interaction in the form of an email network bring about distinctive collective patterns of behaviour?

This gradually becomes an explanatory strategy, inquiring upon:

How are the basic elements of human interaction formed and how do they develop?

What patterns of relations are there? and how can they be identified?

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How are these patterns of relations associated with the electronic networks that support them?

The above questions are designed to help the researcher focus on the key elements of networking that are being investigated. This does not mean, however, that the researcher is in any way restricted to the above questions. In being part of the phenomenon being investigated, the researcher may have to modify some of the above questions in the light of her observations and of what she learns about the situation.

Levels of Networking

In order to interpret our observations and description of the network, we must address issues pertaining to networking. In this section we present key questions that we address when investigating the instances of networking at each of the five levels.

At the first level, Networking 1 the technology of networks affecting the case study are described. Technical issues regarding the existing technological structures and use are considered. In particular, issues of connectivity, security and the integrity of the technology need to be investigated at this level of networking. Questions of

What technology is currently in place? what is it used for?

How does it operate?

How is it managed and by whom?

To what extent are security and integrity considerations met?

What is the connectivity and portability of the systems in operation?

What was it designed (intended) to do?

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are addressed.

In Networking 2, the work process and the salient factors affecting it are described. Issues pertaining to the effective and efficient achievement of the objectives of the work group are considered at this level. In particular, interpersonal communication, cooperation and the ease (or difficulty) with which information is exchanged are considered. Questions of

What are the work processes and how are they carried out?

What are the available skills and information?

How are relevant skill and information accessed and shared?

In so far as technology is used, to what extent does it support and facilitate the work process?

Is anything useful achieved in the work group?

Does the work process have any internal and external validity?

are addressed.

In Networking 3, organisational issues are taken into consideration. The shape/structure and direction of an organisation affects the different ways in which the organisation performs. At this level, issues pertaining to the networking processes within organisations are considered. In particular, the cultural considerations, such as regimes associated with hierarchical structures, must be described and the nature of the organisational boundaries established (these may be physical or symbolic in nature). Questions of

What are the prevalent organisational forms involved?

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What reporting and control structures do they use?

How are decisions made according to official channels? in reality?

Are there mechanisms for managing the skill and information resources of the organisation? and, for bringing about learning?

To what extent is there (or is there a lack of) cohesion, coordination and mechanisms for integrating within the organisation?

What are the prevalent environmental factors affecting or dictating performance?

To what extent is there reliance on and support for information technology?

How does IT affect organisational structure and performance?

are addressed.

In Networking 4, associations are identified in situations that take the network beyond organisations towards a less distinct, dispersed reality. The rise of electronic highways that support communities in cyberspace, specialist groups and those that facilitate trade, transfer of funds and the integration of organisations have brought with them a range of both technical and management concerns. Questions of

What is the prevailing emergent purpose?

What groups, organisations and countries are involved?

What people, organisational and regional links are there?

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How are the linkages among people, organisations and regions supported and facilitated by the electronic networks?

What type of collaborative efforts govern the development use and maintenance of the shared networks?

are addressed at this level.

In Networking 5, it is necessary to address the societal considerations governing the global communications infrastructure and its functioning. There are certain very distinct issues of national responsibility for the development and maintenance of electronic communications infrastructure. In particular, there is the long standing debate of the extent to which national governments can permit themselves to regulate what transpires on the information highways. The growing use of electronic networks that support communities of experts across countries and continents are seen as a threat by national governments that fear a loss of power over the minds of their citizens. And yet there is at present no international body authorised to oversee that the rights of the individual in global information highways. Issues in the global information economy arise from the possibilities of unencumbered transit of information across national boundaries. There is as yet no legislation pertaining to the security, privacy and ease of access to the data being transmitted. At this level, questions of

Is the use of electronic communications technology seen as a privilege or as a right?

To what extent are the civil liberties in cyberspace protected from government intervention? and/or computer crime ?

Who has the responsibility of developing and maintaining the global communications infrastructure?

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Are the existing international organisations and regimes well suited to governing the global communications infrastructure?

Is prosperity or societal development achieved through fostering the use of electronic communications technologies?

must be addressed.

Some activities are more exposed to socio-economic restrictions, such as the publication of material through the use of an electronic mail link in an African country where the government exercises strict control over information diffusion and is opposed to satellite links. Other activities are more secluded and are affected by more concrete technological considerations like the cost and speed of a modem. The effect of government intervention may be considered from a networking 5 perspective whereas technological considerations require a networking 1 level of analysis. Networking 1 situations can be analyzed using rigorous modelling techniques, whereas a networking 5 situation has to be considered in a much more softer manner.

The choice of technique for representing the phenomena described within the layers of networking are not as important as identifying the qualitative differences that underlie and influence a situation. In particular, the implementation and use of information technology is affected by factors ranging from the choice of hardware and software to the political situation; these can be seen to influence the long term effects of using the technology. Following an interpretation of the case study at each of the above levels, an analysis of the structures and patterns of behaviour of the human actors is carried out. The design of the case study entails a careful selection of the unit of analysis, sources of evidence and mode of data collection. These are considered separately in the following sections.

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Unit of analysis

According to Yin (1984), it is important to be clear about the unit of analysis. There are a number of different electronic networks that form part of the case being investigated which are varied in their scope and the facilities that they offer. Some span the globe while others are restricted to their region and purpose. They incorporate constraints relating to connectivity to other networks, accessibility by institutional and/or individual users, volume of data that they are able to transmit and the costs of using them. It is difficult and inappropriate to consider any one electronic network as a unit of analysis as the networks are inextricably linked by a variety of gateways and have a much broader effect than a consideration of specific electronic networks may underscore.

In view of this, the unit of analysis in this research is the Commonwealth Secretariat's Network of Information Technology for Development (COMNET-IT) based at the Secretariat in London as it is a network and lends it itself to the investigation of both human and electronic networks. This network is composed of a number of networking projects that have the underlying purpose of bringing together groups of geographically dispersed experts; electronic networks are used as a means of communication while the human networks are the basis of collaboration. For the purpose of this investigation, electronic networks supporting the human networks under consideration are described according to the number of users that they have and the extent that they are used (measured in terms of volume of data). The nodes on the electronic networks are hosts owned by specific institutions that allow access to a range of users and provide services to their own members and other institutions. Often each node may act as a host to more than one electronic network.

Sources of evidence

The diversity and volume of material available to the Coordinator was extensive. The sources of evidence for this research constitute COMNET-IT documentation and material arising from activities that are associated with COMNET-IT. These sources are described as follows:

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Official documentation of COMNET-IT. This comprises of conference proceedings, workshop reports, project outlines and the constitution of COMNET-IT.

Publications and other studies carried out in the area of electronic networks and their use.

Task Force Leaders of COMNET-IT, and other human networks.

System operators at electronic network hosts in Africa and printouts of users registered at the host.

Email traffic over time. Volume of data, length and maintainability, connectivity.

Transcripts of electronic meetings.

The above sources provide the researcher with information on the COMNET-IT network in addition to what she observes by being part of the network and coordinating its activities.

Collection

Data on human networks was collected by way of discussions, informal interviews, and transcripts from electronic meetings and interrogation via email. Attendance at conferences, both academic and inter-agency were very useful in collecting information on a variety of perspectives on networking and on reasons for funding electronic networking initiatives. In particular, the IFIP WG9.4 Conference on the Social Implications of Information Technology in Developing Countries held in Havana, Cuba, was very useful in discovering further issues to be considered.

Relevant books, and publications were gathered from libraries. Project documents and

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reports on other international agency initiatives were readily accessible to the coordinator. Data on electronic networks was collected through electronic mail. Anonymous file transfer protocols, queries and searches through the network enabled collection on connectivity of networks and their accessibility. Data on users and volume of traffic was obtained from network operators and directors of departments of the institutions running host computers. In particular, a consultant for IDRC, Mike Jensen, provided first hand experiences on the implementation issues and use of electronic networks in Africa.

Guiding Themes and Procedures for Analysis

The approach to analysis of COMNET-IT considers current thinking on organisations and information systems research. The analysis also considers the Group Support Systems perspective as it appears to be well suited to describing the communication relations among participants in an electronically supported work process. It follows the mode of structuration theory and social network analysis (also known as structural analysis) to analyze data from the transcripts of electronic meetings. The electronic group meetings in COMNET-IT are seen to exhibit patterns of relations. Studies have shown that patterns of relations emerge when groups interact using electronic communication technologies (Sproull and Kiesler 1991b). Structural analysts found that human networks demonstrate certain behavioural patterns that are different from the behavioural patterns of the other human networks (Galaskeiwicz 1979). Using the theoretical concepts of social network analysis, patterns of relations may be highlighted and the behaviour of the actors examined.

For the purpose of this research, qualitative data analysis is used to identify patterns of relations and "mechanisms going beyond sheer association" (in the words of Miles and Huberman (1994)). The analysis of data is supported by a Hypercard tool constructed using the concepts drawn from social network analysis. This tool serves to analyze the transcripts of electronic group meetings according to the behaviours exhibited by each of the actors. It also allows parts of transcripts relating to COMNET-IT activities to be examined and compared. In this way, it is hoped that insight may be gained as to why

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certain patterns of behaviour occur and how these may be conducive towards bringing about greater collaboration and coordination of activities. This research investigates networks a) within the approach of five levels, and b) as structures in patterns of behaviour. In doing so this research may establish the extent to which the theoretical approach developed in this thesis has explanatory power.

Potential for Generalisation

This research does not use the case study to validate a theory or hypothesis, but it does have the potential to arrive at generalisations. It has representativeness in that it addresses the broader aspects of networking using the five levels and is clear about the domain of investigation. It has rigor in that the research is designed: it begins as an exploratory strategy and then becomes explanatory in which informed choices are made about site selection, sources of evidence, collection of data and analysis.

At the same time, an in-depth description of reality is enabled by the researcher being part of the case study. The interpretations of the researcher are guided by the five levels of networking and are not altogether compromised by the bias of the researcher and her choice of informants. Explanations to account for why people behave in the ways that they do and the identification of causal relations are sharpened by the use of theory. According to Steinfield and Fulk (1990), theory can:

1. *provide road maps as to what patterns to look for in the data,*
2. *point us toward explanations for the patterns,*
3. *help resolve inconsistencies across studies, and*
4. *help to account for anomalous findings.*

In this research, structuration theory sensitises us to the more subtle nuances of networking, enabling us to account for some anomalous findings, and social network

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analysis provides us with a road map as to what patterns to look for in the data. The use of theory to help us explain our findings enables us to generalise upon certain features of networks that may apply to other contexts. This research approach may also provide insight into how to use this combination of theories in other research strategies.

Summary and Conclusions

The chapter begins with a statement of the need for information systems research to have a better understanding of the context within which information systems are used and developed. In the light of contemporary perspectives on information systems research, an approach is developed for the purpose of this research. While the use of the case study in its own right may be contentious, the approach of this research is designed to make it both representative and rigorous. It follows an interpretivist strategy that takes the premise that the meaning that social actors ascribe to their particular realities is important. The role of the researcher is seen to be interpretivist, to construct explanations that account for the way in which subjective meanings are created and sustained in a particular setting. While the researcher is part of the phenomenon being investigated, her role is not interventionist and nor does it form part of an explicit change process.

The approach of levels is intended to guide the interpretation of the case study and provide a focus for analysis of the data. Analysis of network structure and behaviour is carried out using a combination of theoretical constructs from structuration theory and social network analysis. This way of investigating the network phenomenon using theory enable generalisations to be arrived at of patterns of relations and provide explanations for their behaviour.

What can be done with one substance must never be done with another. No two materials are alike.

Ayn Rand

Chapter Three:

Organisational Perspectives

Chapter Three: Organisational Perspectives

Introduction

Although organisational analysis is limited to formal work processes that take place within the physical boundaries of the organisation, it does provide us with a basis upon which to look at the ways in which work processes are structured and made to operate in synchrony. COMNET-IT is a network composed a number of different types of loosely defined activities. The work processes that it comprises are often dispersed across many geographical locations but are nonetheless endowed with features of traditional task structures. To this end, it is deemed necessary to consider the literature on organisational theory and its influence on information systems research and practice.

This chapter considers the prevailing themes inherent in the study of organisations. It begins by presenting the commonly accepted notions of organisation in the light of recent trends. It then traces the evolution of current thinking on organisational structure. Management theory and practice together with the more recent theories of organisation are used to highlight certain influential elements of organisation. A discourse on organisational structure and information technology points to the duality of this relationship; in this, the technology is seen to have a liberating effect by some writers and by others it is seen to have a dehumanising effect on the work process. The indirect contribution of information systems research in this has been to facilitate and support problem solving and learning mechanisms within organisations.

Channels of interpersonal communication are seen to transcend organisational boundaries and sometimes even become work processes in their own right. In view of the restricted nature of the organisational theory, the need for a modified perspective is proposed and contemplated in the light of broader perspectives.

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Organisation and Information

It is accepted by many academics and businessmen (such as Galbraith 1973, Tofler 1984, Drucker 1988, Rockart and Short 1989, to name a few) that today's organisations face an environment of accelerated change in which organisations rely more and more on people to make decisions on matters for which a routine response does not exist. A commonly accepted view that has been put forward by Galbraith (1973) and others (Lawrence and Lorsh 1967, Kanter 1985 for example), is that organisations respond to uncertainty by specialising their parts. This in turn requires the existence of integrating mechanisms to enable the different parts to operate in synchrony, and to coordinate their activities. Personnel departments are considered to be formalised integrating mechanisms (Lawrence and Lorsh 1967) that have traditionally taken up this role by ensuring job mobility within an organisation. This is not always that case as the more informal integrating mechanisms often play a more significant role. Information has the effect of an informal, undefined integrating mechanism. Galbraith adds that as an organisation faces new and different situations, operating rules and procedures have to be supplemented by integrating devices and the need for coordinating these parts increases with increased specialisation; he also claims that there is an increase in the centralisation of control.

Information for coordination

More information is now required for the purpose of coordinating parts of an organisation and for controlling these parts. Differentiation of the parts of an organisation and their diversity raises the level of information required for coordination and integration. Alvin Tofler (1984) suggests that we are in the Third Wave which:

.. creates a new civilisation which is composed of more differentiated and more specialised parts. We are moving beyond the stage of mass production, distribution and communication; if the division of labour is becoming even more refined; if the variety of organisational structures is increasing; if we are moving toward smaller, more numerous, more decentralised units (sometimes organised within very large organisational frameworks); if our laws are

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multiplying and our products, values and attitudes becoming more heterogeneous; if all this is happening then it takes far more information merely to keep the whole system in equilibrium.

These remarks touch upon a vast array of changes that permeate our age, the age of information (Tofler 1984, Roszak 1986, Saxby 1990). It is believed by some management writers and organisational theorists alike, that information technologies have become the driving force leading to the redefinition of organisations: their boundaries, their business environments, and indeed the very nature of their function and their role in society. The notion of an organisation is not the same as it was when mass production and distribution were the norm, it has become broader and less distinct and the differentiation and specialisation of parts can be seen as an outcome of the emergence of a new form of organisation.

According to Simon (1976), in order to be successful, the behaviour of a group of people should not only involve the adoption of correct decisions, but also that all members of the group carry out the same decisions. Coordination, he claims, may be either procedural or substantive in nature. Procedural coordination establishes the lines of authority and outlines the sphere of activity of every member, while substantive coordination specifies the content of an individual's work. An organisational chart specifying reporting relations is a form of procedural coordination whereas, substantive coordination may range from guidelines for the design of a product to blueprints in factory production processes.

Changing nature of the workforce

The division of labour is becoming more refined, labour is no longer just a unit of production, a resource available for production, it is taking on a new role. The worth of an individual is no longer entirely determined by their skill and the amount that they produce. It is becoming increasingly apparent that a mixture of skills, the ability to acquire new skills and the ability to access, possess and use appropriate knowledge and information for a broader set of activities, are required to achieve changing targets for

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performance. Drucker (1988) refers to the workforce of this type as knowledge specialists because every individual possesses a specific type of knowledge and skill that is necessary to perform the tasks that are allocated. These workers are referred to as information workers (Zuboff 1988) as they produce and have access to the basic information that is specific to their responsibilities and are essential for the efficient functioning of an organisation.

Soshana Zuboff (1988) writes about the trend of democratisation of employees working in the low, operating ranks of the organisation. People at the operating level who produce information, now have greater control over the outcome of many decisions that permeate from the higher echelons of management. It is not only possible for individuals at lower levels of the organisation to make important decisions but it is increasingly becoming a necessity as decisions based on skill and expert knowledge are required in order to ensure productivity or quality gains and appropriate responsiveness. It is increasingly becoming a matter of achieving appropriate responses to an environment in which new criteria for performance have emerged and there are new requisites for individual and collective power, and new mechanisms of accountability have to be instigated.

Restructuring of organisational processes

The move towards smaller, more numerous, more decentralised units is seen by many to suit the complex and information rich nature of modern organisations well (Drucker 1988, Coulson-Thomas 1988, Morgan 1986, Malone and Rockart 1991). Such organisations need to exhibit characteristics of coordination, communication and control, and use of information and specialised skill in order to achieve their diverse and specialised ends. A further pressure towards numerous, smaller, decentralised units results from the increase in the importance of teams comprising of individuals representing different functions and a mixture of skills to contribute. Often these teams are dispersed across different parts of the organisation. This results in the spatial and temporal distribution of work (Jones 1991) allowing activities to be performed by a geographically distributed team of experts.

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If we assume that the objective of an organisation is to improve its performance by enhancing its ability to cope with changes in the environment, then, unprecedented changes in the environment require responses that are often not part of routine operating procedures. This has brought about a trend towards restructuring organisational processes and operating procedures. There have emerged a multitude of suggestions as to how the rapidly burgeoning information resource can be tapped and exploited towards achieving the disparate activities of the organisation (Cash 1985, Charan 1991, Cole 1985). Traditional notions of organisation have often reflected mechanistic work processes such as inventory control. The result has been the well defined structures and boundaries that have prevailed in the past. More recently the work process has become more fluid, building upon a number of interpersonal relations that often involve people from a number of different organisations. The concept of organisation thus needs to be recast in the face of the changing nature of the work process.

People and indeed organisations have to respond to these changes and remain competitive in an environment where the criteria for competitiveness are constantly being adjusted. Competitive advantage is seen as is the development of linkages between the activities performed in different parts of the organisation as well as between different organisations. Michael Porter (1985) has identified value chains which he defines as systems of interdependent activities connected by linkages which exist when the way in which one activity is performed affects the cost or effectiveness of other activities. Careful management of these linkages is claimed to be an important source of competitive advantage and creating competitive advantage entails an optimisation and coordination of these links. The effect of information technology is in transforming the way in which these activities are performed, it also provides the capability to exploit the linkages between the activities and creates new linkages by generating new flows of information. Michael Porter's value chain hypothesis forms the basis of the management view of networking. Business Process Redesign which is intended to guide IT investments and redesigning business processes that best exploit investments in IT. This is taken further in developing strategic opportunities derived from business networks. This is known as the Process of Business Redesign (In Scott-Morton 1991).

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Information technology has been instrumental in bringing about this transformation of organisation. It is believed (Drucker 1988, Child 1988) that information technology has brought about wider, more flexible spans of control whereby it is possible to monitor the work of a large number of employees, it has also led to flatter structures because the need for middle managers as siphons and distributors of information is no longer a critical factor in the dissemination and distribution of information. Instead, new roles and jobs are emerging that depend on the existence and use of communication channels and the use of diverse contacts based on formal working relations as well as on informal interpersonal interactions. In the light of these trends, the structure of organisations is recast as more work is being done collaboratively and in teams.

Need for learning processes

These developments also necessitate that organisations develop an ability to learn, an ability to acquire information, and to develop and remember how to use it for problem solving and decision making. The importance of this cannot be underestimated, especially given the need for organisations to increase their collective reservoir of knowledge and skill. Along with the changing role of information, the character of information is changing. The need for larger amounts of information is apparent in most modern organisations where there is a build up of too much information to too little effect. It is increasingly becoming a concern within most organisations today that the individuals within should have access to relevant information when it is required. This means that both formal and informal communication processes must be used effectively.

In view of these developments it is important to be aware of the mechanisms that generate information, transfer it and utilise it. Indeed, it is this information that forms a vital component for the survival and ongoing development of any organisation. It is worth investigating the information used and required to coordinate the diverse parts. The diffusion of this information, and how it forms the knowledge base of the organisation is the result of the learning processes that encompass the individual's efforts, group and organisation's collective experience. It is also important for people to be able to recognise what information is needed and when, and to have the ability to locate,

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evaluate, and use it effectively. It is a matter of knowing how to learn. This means that it is necessary to know how knowledge is organised, how to find information and to be able to share this information. This is not just data on transactions but also the experiences of others, the stories that they tell and the understanding that they share; collectively, these are referred to as 'know how' that contributes to an organisation's ability to perform and react to its environment (Argyris 1980).

In view of the increasing importance of the individual's knowledge and ability to learn, along with the increasing need of modern organisations to harness a varied and ill defined pool of skills, the structure of the organisation is being transformed. The organisational paradigm has often been used as a means of describing the ways in which the structure of the workplace can be made to function in accordance with the purpose of the organisation. Designing and developing the workplace has been one of the prime concerns of organisational theorists. It is necessary first to consider the view of some of the influential writers on organisational structure and then to proceed to describe information systems research in the light of these developments in organisations.

Organisational Structure

The notion of organisational structure has been widely studied and written about (Child 1984, Lawrence and Lorsch 1967, Burns and Stalker 1961, and Mintzberg 1991 among others). Organisational theorists such as Child (1984), see the structure of an organisation as being comprised of groups of people that have to be organised in order to enable an organisation to develop and not to decay. Taken in this context, organisation theory can be defined as the study of the structure, functioning and performance of organisations and the behaviour of groups and individuals within them (in Pugh *et al.* "Organisation Theory" 1984). The main theme taken by some writers (Schermerhorn 1985, Locke and Henne 1986) is behaviour and how it can be modified in groups and individuals in order to achieve a desired goal. Organisational structure is further often seen as a management tool to determine the optimum degree of control necessary to operate efficiently.

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According to such organisational theorists, the structure of an organisation and its relationship with the environment in which it operates affects performance (Lawrence and Lorsch 1967, Burns and Stalker 1961). The role of an organisational analyst is to identify problem areas and propose remedial action intended to improve performance. The problems within organisations have been classified into those involving work motivation (Locke and Henne 1986), group dynamics (Cartwright and Zander 1956), management authority (Bendix 1956), management control systems (Woodward 1970), organisational structure and design (Perrow 1979), intra-organisational conflict (Crozier 1964, Child 1984), resistance to change (Keen 1976), participative approaches (Land and Hirschheim 1983, Mumford and Weir 1979), and strategic choice and the environment (Chandler 1962).

Each of these issues and perspectives are addressed in different ways by different organisational theories; the most significant of these are scientific management, human relations, socio-technical (a systems approach now also used by organisational theorists), contingency theory, industrial relations, cooperative labour strategy, Japanese management (theory z), and human resource management (all summarised in Pugh 1984). Some of these organisational theories have been very influential in shaping the way in which the workplace is organised. Their historical development also sheds light on the way in which organisations have been structured and the pressures that they have had to face in the past.

From Scientific Management to Contingency Theory

Scientific Management, as formulated by Fredrick Taylor, emerged out of an era of rapid industrialisation that brought with it a need for the efficient utilisation of a largely unskilled workforce. Scientific management paralleled the rise of the industrial revolution by its efficiency in mass production. A change in the patterns of work and increased emphasis on the need for more humane working conditions, led to a reassessment of the merits of this form of organising work. The pendulum swung in the opposite direction when the focus shifted towards protecting workers and building a legal framework within which they could appeal against exploitation; organisational analysts refer to this as a

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human relations strategy. The next stage was the rise of militant trade unionism that proliferated in almost every sector of industry. This called for an industrial relations strategy in which management was forced to negotiate with the trade unions through various forms of, often aggressive, bargaining and negotiation. Wages increased and better working conditions became the norm. From the perspective of employers, it was becoming increasingly expensive to employ people. At the same time, it became more cost effective to apply more technology to production processes than it was to employ additional units of labour. Studies by the Tavistock Institute illustrated that substituting technology for labour does not of necessity lead to an increase in productivity. Instead, they found that in order to achieve productivity gains, it is important that both the social and technical components of a production process are aligned.

The emphasis shifted from the management of a mass of largely unskilled labour, to redesigning organisational processes, at the same time skills were being developed in line with the rapid industrialisation of the economies. It became increasingly apparent that organisations differ in so many respects that researchers in organisational theory began to delve into structure and its relationship with the environment. A body of knowledge under the heading of contingency theory arose delving into the why organisations are structured in the way that they are. A number of organisation theorists have written about organisational structure in these terms with little or no consensus emerging as to which is the most appropriate form or organisation. A commonly accepted view among contingency theorists is that organisational structure is a response to the environment within which it operates and may be perceived in a number of ways.

Mechanistic vs Organic structures

In their studies of the electronics industry in Scotland in the 1950s, Burns and Stalker (1961) established that the structure of an organisation is a response to the environment in which it operates; they state that:

The way in which a concern confers and defines rights and obligations [to control] constitutes the management system. The form of the system varies

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with the nature and concern's task. The degree of stability and rate of change calls for different systems by which the activities of a concern are controlled, by which information is conveyed throughout the organisation, and by which decisions and actions are authorised.

They suggest that, in order to survive or be effective, organisations operating in stable environments will have mechanistic structures and those operating in dynamic environments will have organismic structures. These conclusions were derived from empirical findings from the firms studied by Burns and Stalker. There is evidence to suggest that Burns and Stalker may have been influenced to some extent by structural functionalism (Talcot Parsons 1960) - a body of knowledge that brought biological thought to bear on organisational theory. Of particular relevance to the study of organisational structure is the way in which Burns and Stalker (1966) describe the properties of mechanistic and organismic management systems. A mechanistic management system that is appropriate to stable conditions is characterised by:

- 1. The specialised differentiation of functional tasks into which the problems and tasks facing the concern as a whole are broken down.*
- 2. The abstract nature of each individual task, which is pursued with techniques and purposes more or less distinct from the concern as a whole.*
- 3. The reconciliation, for each level in the hierarchy, of these distinct performances by the immediate superiors.*
- 4. The precise definition of rights and obligations and technical methods attached to each functional role.*
- 5. The translation of rights and obligations and methods into the responsibilities of a functional position.*

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6. *Hierarchic structure of control, authority and communication.*
7. *A reinforcement of the hierarchic structure by the location of knowledge of actualities exclusively at the top of the hierarchy.*
8. *A tendency for vertical interaction between members of the concern, i.e. between superior and subordinate.*
9. *A tendency for operations and working behaviour to be governed by superiors.*
10. *Insistence on loyalty to the concern and obedience to superiors as a condition of membership.*
11. *Greater importance and prestige attached to internal(local) than to general(cosmopolitan) knowledge, experience and skill.*

On the other hand, Burns and Stalker (1966) describe the organismic form as being appropriate to conditions which give rise to fresh problems and unforeseen requirements for action. They claim that the organismic form is characterised by:

1. *The contributive nature of special knowledge and experience to the common task of the concern.*
2. *The realistic nature of the individual task, which is seen as set by the total situation of the concern.*
3. *The adjustment and continual redefinition of individual tasks through interaction with others.*
4. *The shedding of responsibility as a limited field of rights, obligations*

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and methods.

5. *The spread of commitment to the concern beyond any technical definition.*
6. *A network structure of control, authority and communication.*
7. *Omniscience no longer imputed to the head of the concern; knowledge may be located anywhere in the network; this location becoming the centre of authority.*
8. *A lateral rather than vertical direction of communication through the organisation.*
9. *A content of communication which consists of information and advice rather than instructions and decisions.*
10. *Commitment to the concern's tasks and to the 'technological ethos' of material progress and expansion is more highly valued than loyalty.*
11. *Importance and prestige attach to affiliations and expertise valid in the industrial and technical and commercial milieux external to the firm.*

Burns and Stalker describe a self balancing system of social relationships that govern the nature of organisational structure. They state that the basis for self motivated relationships of career structure, working organisation and political system are contained in any concern. The career structure and the political system influence the constitution and operation of the working organisation and have the potential of diverting the organisation from purposive adaptation.

Another key insight into organisational structure is the work of Lawrence and Lorsch

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(1967), who studied organisations in the plastics, food and container industries; the plastics industry was most dynamic and the container the least. They found that high performing organisations in all three industries had structures that met the demands of the environment better than those of their competitors; they had higher profits and greater market share. High performing organisations in the plastics industry had higher degrees of differentiation and integration of the differentiated parts than those of the container industry. They concluded that organisations operating in dynamic environments require more integrating mechanisms than those operating in stable environments.

Chandler (1962) observed that the strategies of companies such as Du Pont, Sears, General Motors and General Electric are all driven by changing pressures in the market. Market-driven proliferation of product lines led to a shift away from a functional monolithic (mechanistic) structure to a more loosely coupled (organic) divisionalised one. Similarly, a strategy of differentiation was seen to entail an organic structure with integrating mechanisms whereas a more efficiency orientated mechanistic structure was seen as more appropriate to carrying out a strategy for cost leadership.

Another popular view provided by Mintzberg (1991) is the concept that organisations have structural configurations. He claims that there are five ways in which the structure of an organisation may be seen, these are:

1. *The Strategic Apex involves the board level ensures that the organisation achieves its mission.*
2. *The Middle Line consists of middle managers in functional areas and supervisors.*
3. *The Operating Core consists of those carrying out the basic work of the organisations.*
4. *Support Staff are those working at ancillary departments like the mail*

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room, cafeteria etc.

5. *The Technostructure consisting of DP departments, administration and the like.*

Each of these parts compete for resources, power and influence, and the dominant part 'pulls' the organisation towards its own ethos. The Strategic Apex pulls to centralize, The Middle Line pulls to 'balkanise', the operating core pulls to professionalise, the support staff pull to collaborate and the technostructure pulls to standardise.

A central theme of these writings is that the more uncertain and complex the context, the more organic or flexible the structure needs to be, and the greater the need for information to flow in both directions vertically between levels and horizontally between functions. In contrast the more certain and less complex the context, the more mechanistic the structure with greater emphasis on hierarchy, standard rules and procedures.

Management Theory and Practice

It is clear that management practice has been influenced by the writings of such organisational analysts. The area of business administration and management is largely engaged in the study of organisation and how to maximise its performance and the structuring of organisations is seen to be a major factor affecting organisational performance (Thompson and Strickland 1987). The objective of management practice is to create a structure that suits the need of a particular enterprise or institution, while achieving consistency between the various aspects of that structure and being able to adapt it to changing circumstances over time.

Of particular influence upon management theory and practice has been the work of John Child (1984) who suggests that there are three main aspects of organisational structure which can assist managers in attaining their objectives. First, structure contributes to the successful implementation of plans by formally allocating people and resources to the

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tasks which have to be done, and by providing mechanisms for their coordination. Second, various structural operating mechanisms or operating procedures set out the ways in which tasks are to be performed. Third, provisions for assisting decision making and associated information processing requirements procedures also form part of the structure. Child explains that the structure of an organisation is taken to comprise all the tangible and regularly occurring features which help to shape its members' behaviour. He states that there are certain components of organisational structure that need to be in place in order to achieve efficient performance. These are:

1. *The allocation of tasks and responsibilities to individuals.*
2. *The designation of formal reporting relationships, determining the number of levels and in hierarchies and spans of control.*
3. *The grouping together of individuals in sections or departments*
4. *The design of systems to ensure effective communication of information, integration of effort, and participation in decision making processes.*
5. *The delegation of authority together with associated procedures whereby the use of discretion is monitored and evaluated.*
6. *The provision of systems for performance appraisal and reward which help to motivate rather than alienate employees.*

These components appear to be a mixture of elements from mechanistic and organismic structures and are believed by John Child to cure the ailments of organisations. He adds that the informal elements of organisation, whether officially sanctioned or not, have to be recognised as part of organisational design as they often point to structural deficiencies. Yet, he was writing at a time when large businesses, especially

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multinationals, were experimenting with the matrix form of organisation that was gaining impetus as an alternative to the hierarchical form of organisation. Both functional and product departments were merged to bring about a structure in which employees were overseen by two or more superiors from different departments. In addition to this new structure were a range of issues or, as described by Child, organisational choices, pertaining to job allocation, span of control (tall or flat), groupings (functional, product or matrix), integration, control, design of reward systems, strategic development, application of new technology, and change management.

It is worth realising that in the end, the way in which the structure of an organisation is known to affect its behaviour (a notion advocated by systems dynamics professionals) depends largely upon the patterns of human relations and their development. In this vein, the following definition, by Sandra Dawson (1986), also considered to be a contingency theorist, may give us some insight into the nature of the structure of an organisation.

The structure of an organisation is the socially created pattern of roles relationships that exist within it. The tool may serve to coordinate the tasks and activities performed by members of the organisation (i.e. to ensure compatibility of parts) and to control... in a way that individuals or groups are guided or forced to act in ways determined by others and reflect dominant interests.

According to Sandra Dawson, structure is a tool that at best facilitates effective coordination and control from the point of view of some interest groups and at least represents remnants of history and misjudgment by serving no-one's interests. In the same way, the structure may also resist attempts to coordinate and control.

Organisational Structure and Information Technology

However, the structure of an organisation does not entirely reflect the socially created patterns of roles and relationships that exist within it. Organisational structure may also

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reflect the technologies that are used. Often, technology dictates the way in which the work setting is arranged. In her study of 203 manufacturing firms in south Essex, Joan Woodward (1970) found that firms using similar technologies had similar organisational structures. She differentiated among firms requiring technologies for unit production, mass production and process production. It appeared to her that different technologies imposed different kinds of demands on individuals and organisations, and that these demands had to be met through an appropriate form of organisation. The differences among firms were also related to factors such as their historical development, background and the personalities of the key players (as in Gasparini's (1976) studies), but these, claims Woodward, were not as significant as the differences between one production group and another; the differences between these groups appeared to be limited by technical considerations. For example, although there were differences between managers in their readiness to delegate authority, it was possible to generalise upon the observation that there was a greater delegation of authority in process than in mass production firms. She reported that the number of levels of authority in the management hierarchy increased with technical complexity, and the span of control of the first-line supervisor reached its peak in mass production.

A number of authors have written about the relationship between organisational structure and Information Technology (IT). Some have attempted to make assessments of the impact of IT in terms of which part of the organisation dominates (Mintzberg 1980); Dawson (1986) views this impact as a product of the social processes within organisations; Blauer (1964) claims that the impact of technology on the work organisation is deterministic; Child (1988) and Zuboff (1988) analyze the impact in terms of integration and control; and Drucker (1988) speaks of the advent of the information based form of organisation that transcends the matrix. Both Drucker (1988) and Woodward (1970) report on the way in which information technology has brought about wider spans of control and flatter organisational structures. The work of this dissertation builds on this view and attempts to make similar assertions regarding the impact of communication technology on the structure of roles and relationships.

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A dual effect

Many authors who have studied the relationship of information technology and the organisation have observed a dual effect. The technology affects the organisation in a pervasive (Roszak 1988) or liberating (Zuboff 1988) manner, whereas the organisation also has an impact on the development, use and success of the technology. In other words, an organisation has an impact on the uptake and use of IT while IT affects the structure and performance of organisation. This dual effect may be seen as being part of the overall complexity of the organisation, a consequence of the multitude of interactions that take place within and around it, and the culmination of the history of the organisation, the way in which it has achieved its present state. In view of this reflexive effect, one may inquire whether an organisation lends itself to external control or managed intervention? and under what circumstances does IT contribute to particular effects (such as centralising, liberating, flattening)?

The contingency theorists' favourite, the matrix has been seen as an answer to the problem of balancing the dual effect. However, problems of job satisfaction due to badly defined work roles, stress of workers due to over exertion are among its many drawbacks that have contributed to its declining use and importance. In a very insightful article by George and King (1991) in which the issues surrounding the debate of whether computer technology brings about centralisation or decentralisation are presented and discussed, it was found that often IT is merely a tool for those in power to implement their own policies. The importance of managerial intent and action centred around the notion that computing leads to centralisation because management wants centralised control and will use computing to achieve it; the opposite is reported in cases where managers want decentralisation. Although these causal relationships are not consistent or clear, what does emerge is a strong, observable tendency toward the use of information technology to reinforce existing decision and authority structures. The outcome of the debate indicates that the extent to which information technology brings about centralisation of control or reinforces existing authority depends to a great degree, on the particular organisation's context, history, current power structure, management intent, and the environment. They conclude that there is no hard and fast rule for knowing the impact

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of information technology on the control structure of an organisation.

Within this debate, Zuboff (1988) provides us with an eloquent description of her view on organisational structure and information technology. She explains that when the application of IT *informs* the task environment, it makes information available and accessible. The logic of Taylorism is undermined because the worker owns the information produced through the use of technology and engages in a learning process that transforms data into meaningful information and finally into insight. She states that, at the advent of the industrial revolution, management authority was on the basis of knowledge, now workers are just as educated and knowledgeable about their jobs as their masters and the advent of end user computing has given workers more control over their own work and forced top managers to delegate and decentralise for the benefit of the company. For example insurance companies have found it necessary to allow their salespeople to customise insurance policies using specialised packages. Workers who know how to use IT in their jobs need to be motivated not controlled. If not appropriately motivated towards the benefit of the firm, a plethora of incompatible, badly designed information systems will result along with a succession of fervent sectionalism (Zuboff 1988).

However such generalisations cannot be made about the impact of information technology on the control structure of organisations and indeed the society at large. Theodore Roszak (1986) ardently contends that the computer lends itself all too conveniently to the subversion of democratic values through its ability to concentrate and control information. He attributes this threat to the historical development of information technology, namely the ongoing military - industrial drive towards rationalising, disciplining, and ultimately dehumanising the workplace is among the foundation stones of information technology. The thinking that was earliest and most significantly processed into machine-readable and reproducible information was the skill of workers, the talent of their hands, the acuity of their perception, the judgement of their minds. He continues that whenever this has happened, the result has been the transfer of power to the technicians, managers and owners. It is the values of the people

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who pay the technicians and own their products that shapes the uses of the technology and in the wrong hands, this technology has subversive potential.

Information Systems Research

Information systems research is the study of grouping of people, objects and procedures and has the aim of providing information about the organisation and the environment (Avison and Fitzgerald 1988). Despite its roots in the hard sciences, (i.e. computer science and software engineering) some information systems research attempts to move away from its reductionist and scientific basis. The growth of Information systems as an area of research has been fuelled by the rapid development and uptake of information technology. The influence of the human systems over and above the technology has made apparent the need for an understanding of the social settings within which the technology is being implemented, as well as the social impact of this increasingly pervasive technology.

Systems Thinking

Organisations can be seen as open systems communicating with other systems that have to respond to environmental pressures in order to remain in existence (Checkland 1981). Systems Thinking advocates a way of thinking about organisational structure that combines the different perspectives of stakeholders. Stated very briefly, the fundamental principles underlying systems thinking are emergence and hierarchy, communication and control. An organisation is seen as a system that comprises of systems that interact with each other to give rise to new systems at higher levels governed by new laws. Systems interact with each other through communication providing feedback between opposing forces so that systems may be in a state of equilibrium with each other. Systems achieve equilibrium through homeostasis whereby the different systems function in harmony with each other in that the output of one system is sufficient to satisfy the input requirements of another.

In short, Systems Thinking explains that there are elements or systems within organisations that interact with each other and with other elements or systems that may

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not be part of the organisation itself. A related concept, Ashby's law of requisite variety (Ashby 1956), states that an organisation must have sufficient variety or the ability to cope with the environment within which it functions. Ashby's law applies here because often intervention is required for an organisation to develop sufficient variety in order to allow it to cope with the changing environment. Restructuring its processes to make them smaller and more flexible is one way in which an organisation may achieve sufficient variety to enable it to compete.

Information Systems as Social Systems

The principle of 'information systems as social systems' is a valuable and powerful one (Land and Hirschheim 1983). The production and use of information within a particular social setting is a complex web of interpersonal relations. Human interaction and communication is a vital component in determining the need for information and the ways in which information will be used. Checkland and Scholes (1990) describe the development of an information system as an ongoing activity in which human relations have to be identified and information flows defined. An information system need not necessarily have a technical component, but when it does, the social system plays a crucial part in determining the way in which the technology is used.

The social system is dynamic, the patterns of human relations within it are constantly changing and generating new demands for different types of information. With these changes in patterns of relations, the accessibility of information changes in accordance with social forces. The technical component of the information system has to have the flexibility to be changed accordingly. It is these patterns of human interaction, whether defined as formal operating procedures or the informal grapevine, that contribute to the successful development and operation of the computerised information system. Often these human relations transcend a number of organisations and are a powerful force in affecting the availability, accessibility and use of information.

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Development Methodologies

Despite the limited understanding of the impact of information technology on the organisation, information systems development has grown to become an area in which organisational performance and satisfying information needs secures primary consideration. Information systems development methodologies attempt to capture the work processes and implement systems to increase the efficiency and, if possible, effectiveness. A range of methodologies exist, some of which are very structured concentrating on technical rigor, while others take on a more participative, problem solving approach intended to build more useable systems. These range from hard core structured systems analysis and design methodologies emphasising the technological content within which the information systems are being implemented, to soft information systems analysis and design methodologies that focus on the organisation or human context and place considerable emphasis on getting the requirements right and redesigning organisational processes.

Much work has been done on how to implement appropriate information systems within the context of the prevailing constraints. Information Systems methodologies focus on the development of computer based information systems that assist formalised systems in organisations and provide information where and when it is needed and at the correct level of detail (Avison and Fitzgerald 1988). The seemingly appropriate implementation of information technology within an organisation is often armed with methodologies such as Structured Systems Analysis and Design Method (SSADM) popular among government organisations (such as the CCTA). This is primarily aimed at building large, complex information systems as its French counterpart, Merise. In attempting build rigorous technically sound systems, these methodologies are used in a deterministic way and often end up altering the organisational processes within which they are implemented. Examples are illustrated in Cornford (1988).

Avgerou and Cornford (1993), suggest that the ambition of the methodology movement is to establish widely applicable rules or guidelines for good practice in systems development. The traditional development methodologies (such as SSADM) take a life

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cycle approach in which the sequence of stages beginning with a feasibility study and ending with testing and maintenance are well defined. Variations of this allow for iterations between the feasibility, development and testing phases. Avgerou and Cornford (1993, p.169) state that methodologies:

..provide an approach to systems development by recommending a particular sequence of development tasks and methods for executing them. In this way, they provide a structure for organizing systems development tasks, usually based on some variation of the life cycle model, with the addition of mechanisms for monitoring progress. Techniques and tools are generally specified which facilitate both learning and practice of the systems development process.

Although Avgerou and Cornford suggest that the last two points (learning and practice) are less often directly addressed, there is an awareness that they must be addressed even if indirectly. In particular, there are cases in which systems development approaches also support the problem solving and decision making processes in an organisation.

Support for problem solving

Information systems development methodologies which attempt to support problem solving processes approach information systems development from a very high level of abstraction taking the very soft messy organisational issues and work their way down to defining these issues to make them more tangible. A common characteristic of such a methodology is that it emphasises the development of decision making processes and is often instrumental in the reorganisation of work processes as a result of participation (Land and Hirschheim 1983, Mumford 1975 and Checkland 1981). Although the intention of Soft Systems Methodology (SSM) is to highlight a particular situation, it has often been used to achieve consensus through a process of building root definitions and communicating conceptual models. It appears that the main reason for bringing about problem solving mechanisms in organisations is to build consensus in the decision making processes and to achieve organised action.

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In addition, some operational research tools and techniques are moving towards developing approaches to support decision making and improving problem solving in organisations. A recent trend in operational research, has been a move away from mathematical techniques for improving the efficiency of operations to soft operational research methods, known as 'soft OR', focus on problem solving and consensus building for policy making. One such method is the Strategic Options Development and Analysis (SODA). SODA is designed to aid OR consultants in bringing about consensus and commitment within a team (Eden 1989).

Participative methodologies have proven to be useful yet not sufficient in view of the time and cost involved in building consensus among a group of participants. Other techniques and tools involving participation and collective decision making make use of new technologies such as Group Decision Support Systems (GDSS), Computer Support for Cooperative Work (CSCW) and the like (Gibson 1991, Wanninger and Dickson 1992). De Vreede, Sol and Dickson (1994) describe a group decision support systems based approach used by the Amsterdam police force as an aid to their problem solving process. The group decision support system was also used as a means of eliciting requirements for the development of an information system (Atlas of Criminal Organisations and Societal Trends, ACOST) intended to support the work of the Criminal Investigations Department. The problem solving process supported by the GDSS was found to be particularly useful in eliciting the key problem areas from a group of participants and then prioritising objectives based upon the participants' understanding of the problem situation. The problem solving processes instigated using this technology have been found to enhance the process of requirements specification. The iterations between the phases of problem solving and requirements specification have been made more reliable as a result of the greater focus on communication among participants that was enabled by the GDSS.

With the increased involvement of end users in the feasibility and development stages, the popularity of prototyping methods has made it easier for rough and ready computer-based information systems to be built and refined iteratively, especially for the

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purpose of requirements specification analysis. Advantages to prototyping methods include clarification of the target computer system, they enable the adequacy of the proposed solution to be determined and they bring about learning of the scope and capabilities of the information system (Dearnley and Mayhew 1983).

Facilitating learning mechanisms

Building up the capacity of a group of people to respond to certain events, to locate and use certain pieces of information and to bring about certain learning processes is increasingly becoming the remit of analysts, consultants and hybrid managers attempting to redesign organisational processes. Lunquist and Huston (1990) have developed a methodology called Continuous Organic Development (CODE), which they anticipate will increase information literacy, enhance knowledge of organisational problems and the ability to manipulate information. CODE begins by applying Soft Systems Methodology (SSM) to build rich pictures describing real world action; it employs conceptual models of human activity systems relevant to the problem situation. Employing SSM invokes participation and information sharing. The intention is to build on each individual's *weltanschauung* (mental model) in order that the employees will become orientated towards their organisation's knowledge base and will in the process learn about stores of information, how to access and utilise these. Members of organisations participate through CODE to build up their problem solving skills. CODE comprises of two types of activities: 1) local activities which involve role playing and 2) laboratory activities performed by groups using multimedia technology, to facilitate a process of structured debate and learning.

Some go a step further and attempt to initiate procedures for increasing the level of organisational learning (Lane 1992, Morecroft 1987). The extent to which members collectively increase an organisation's ability to acquire new areas of expertise largely depends on the ability of the individuals to communicate and share information. It is argued by writers such as Morecroft (1985), Lane (1992) and practitioners such as Ariel De Geus (1988), at Shell, that the structure of the organisation must be conducive to information sharing and its dissemination. Senge (1992), Morecroft (1987, 1992) and

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Lane (1992) propose learning laboratories or 'microworlds' that are microcosms of real business settings that allow managers to play roles within a simulated organisational environment. The idea is to enhance the mental models of managers as they collectively learn how and in what ways their strategies affect the organisation at large. In this respect, it is the transformation and impact of information that brings about an increase in the extent to which learning takes place in an organisation. They use I-Think models of business process that are developed in conjunction with the participants of the session who are usually managers or decision makers in the area of concern. The structure of a particular process is depicted by the drawing of Causal Loop Diagrams and the behaviour is subsequently simulated using alternative criteria or conditions. The intention is to bring forth the causal relations in the system and obtain a picture of its operation whilst providing feedback on various alternative scenarios.

Argyris (1977) poses learning patterns in organisations that are part of the general process of strategy formulation and implementation. He states that experience with IT leads to greater organisational learning and defines learning as a staged process comprising of short term adjustments and long term transformations. Single-Loop learning, he claims, is when people in an organisation readjust their strategies and procedures according to change in the environment given the existing structure of norms and values. This feedback mechanism requires that the organisational knowledge base is modified every time this adjustment process takes place. Double-Loop learning involves a change in the organisational patterns including norms and values, in order to cope with the demands of the environment. This involves a reassessment of how the organisation sees itself and its business. Duetro-learning is a continuous process of learning in which an organisation has to be able to know when to apply single-loop learning and when double-loop learning mechanisms are most effective.

The realisation that people have to be trained, developed and made to share their experience, knowledge and skill has brought about a range of approaches that encourage participative mechanisms within organisations and in between organisations, increasingly in the form of collaborative projects. A growing trend towards developing the human

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resource has been accelerated by the increasing use of information and communication technologies. The abundance of information and its uncontrollable dissemination has put in the hands of every individual the responsibility of using this information to the best of their ability.

Communication

Channels of interpersonal communication are an inherent component of any organisation and some of these are not restricted to any particular organisation, transcending commonly accepted boundaries. Yet, it is these interpersonal links and the nature of their social interactions that are a significant component of the information rich nature of modern organisations. In general, patterns of communication may be seen to comprise a complex mesh of interrelated activities and processes, entities and actors that collectively perform specific functions in order to achieve a required outcome. And yet, it is worth approaching communication with a degree of caution as the effects of interpersonal interaction may culminate into much more than just patterns of communication. Indeed we can expect a mass of contradictions from all those exchanges of information that may be included in the term communication. To this end, Herbert Simon (1947, p.154) provides us with a simple, candid and insightful definition of communication, he states that:

Communication may be formally defined as any process whereby decisional premises are transmitted from one member of an organisation to another. It is obvious that without communication there can be no organisation, for there is no possibility of one group influencing the behaviour of the individual.

This formal definition of communication is very general but at the same time only accounts for a very small part of what communication is. An implicit purpose of Simon's definition of communication appears to be that of influencing the individual to comply to prerogatives imposed by those who appear to have greater powers or authority vested upon them.

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In the past communication in the enterprise took place on two levels: functional and operational communication (Mattelart and Stourdze 1985); these, are claimed to be directly rooted in production and manifest in rule books, operating methods, and sometimes even codes referring to decision making practices. Now the content of communication has become a strategic space where the interests of the different actors of the system are crystallized. They expound that it is not by chance that the new technologies of communication in the organisation are generally thought of only in very technical terms. It is this convergence of communication technologies and the fabric of modern society that brings forth the rise of a new way of thinking about the possibilities of communication. These possibilities, as proposed by Mattelart and Stourdze (1985), include new forms of organisation, new ways of assigning responsibilities and formulating new training programmes that provide more appropriate qualifications.

Mattelart and Stourdze (1985) provide a very detailed description of the nature of communication in the wake of new information technologies. They define communication as "a political apparatus for the production of consensus and the reproduction of cultural hierarchies" alluding to the idea that there is a distinct function for communication. As much as they find it difficult to delineate communication from the other systems of socialisation, they do provide a picture of the French experience with information technology. They suggest that communication compliments and orientates an apparatus for the industrial production or distribution of information technology; they make no distinction between the form and content of communication as they perceive it to be simply a response to social requirements.

At a higher level, Giddens (1984) provides us with an eloquent description of communication as a social phenomenon. He describes communication as a general element of interaction that includes the intention of communication. Giddens correlates this form of communication with that of physical transportation by declaring that the media of communication are always identical to those of transportation. In his view, the mechanisation of transport has been the main factor leading to the dramatic forms of convergence where the importance of distance is no longer as restricting a factor as it

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had been prior to mechanisation; this he notes is a characteristic of the modern age.

The repercussions of these developments in supporting communication with new technologies has brought about the need for a major rethink in the way in which an organisation is conceived. The patterns of interpersonal interactions that once designated the structure of organisations are changing and taking on different forms. The formal reporting structures of organisations based on strict hierarchies are having to contend with informal communication patterns that are increasingly becoming more and more influential. As explained earlier, a reason for this is that in order to remain competitive, organisations have to have smaller more flexible reporting structures in order to be able react faster and achieve appropriate responses in an environment with new requisites for success (Tofler 1984 and others).

Electronic communication

Writing in the context of human communication via computers, Hiltz and Turoff (1993), envisioned the rise of computer conferencing as the primary form of communication in the information age. In their book, they state that:

Information is a resource with very real economic value that is dependent upon its organisation, timeliness, and relationship to what we normally perceive as human communication. It will be a potential source of economic dominance as we move even further towards an information economy.

Organisations then find themselves in an economy based on a key resource, information, that is not only renewable but self-generating. This resource can to a degree be bought and sold on the market, it is more importantly, a resource essential for the production of other resources. The use of information technology to tap this resource has brought about the need for different organisational structures. Organisations are finding that they are now producing information and using it as a resource, as a means of production, and as a strategic component (Drucker 1988, Ernst and Young 1989, Malone and Rockart 1991). In particular, Mulgan (1991, p.10) explains that:

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knowledge becomes increasingly exterior to its producers and to the trained minds which use it. It takes on the characteristics of a commodity that is priced and exchanged in markets, while culture takes on the forms of flows of electronic information.

An implication of electronic communications according to Mulgan (1991) is that information is a commodity to be controlled. It can be said that the capacity to obtain and process information in the less developed economies is crucial and in the developed economies the main question facing individuals and groups is how to go about locating the relevant information from the mass that is already available.

In this respect, electronic communications technology may be seen as the catalyst that strengthens and speeds the development of interpersonal communication links making them a part of the daily way of working. Initially, this technology brings about new ways of communicating between individuals, groups and indeed organisations; however, in the long term the technology has the potential of transforming the very nature of the organisation: its purpose, its functions and its capabilities (Kiesler and Sproull 1991). Yet, the basis of these changes lies in the very nature of the social processes through which interpersonal interactions are built and develop. The impact of a particular piece of information technology varies greatly according to the social setting within which it is implemented (George and King 1991). One cannot underestimate the significance of the social context: the history, culture, and evolution that form the overall pattern of relations, and the complex web of human interactions.

These patterns of human communication may be seen to form the skeleton upon which the storage, production and exchange of information takes place. This phenomena can be conceptualised as a communication infrastructure that comprises of interrelated links between individuals, groups and organisations. Electronic communication technologies may be part of this infrastructure but are not necessarily an essential component of it. It is the interpersonal connections, the forms that they take and the context within which they are embedded that mould the foundation upon which communication takes place.

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In addition, the social processes that shape the behaviour of these patterns of interpersonal links play a fundamental role in defining the function, development and role of the overall infrastructure of communication.

Need for a Modified Perspective

In order to investigate the networking phenomenon in the context of the development of patterns of relations using the electronic medium of communication, we are left with a handicap when attempting to use organisational theory alone to guide our investigation. The literature on organisational theory illustrates the concept of an organisation as a set of well defined human relations confined within a given set of working guidelines or socially created pattern of roles and relationships. The organisational perspective is limited by the notion that people - structures have certain well defined boundaries. In as much as it is limited by its definition of organisational boundaries, the organisational perspective provides useful guidance in understanding reporting structures and working relationships.

The search for an optimal way of organising tasks and activities in order to achieve productivity targets and superior performance has long been a central concern of organisational analysts. Proposals for restructuring organisational processes and procedures has been one of the primary outcomes of their work. Managing these processes and procedures is connected to the notion of controlling and coordinating tasks and activities, the information flows, and the rights and obligations of members; this forms the basis of managing the enterprise. As stated by Avgerou and Cornford (1993,p.223):

What is lacking from the study of information systems is the equivalent to the sociological discipline of organisational theory... the study of information systems so far has evolved mainly as an intersection between the study of information technology (engineering) and the management of business organisations. The analytical study of the changes of information systems in broader domains, such as a country, a community, a region, or the world is

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as yet in its infancy.

Recent trends in technology and the way in which the technology has transformed work and the way in which the working relations are constituted illustrate a change in emphasis from controlling tasks and activities within a well defined organisational boundary, to coordinating those that are interdependent and widely dispersed. The notion of an organisation defined by its physical boundaries is often not applicable in the wake of the growing interdependence of people, groups, organisations, countries and even regions. Interpersonal relations are becoming increasingly diverse and dispersed over a range of functional and geographical boundaries. Organisations can no longer function without being connected to a number of other organisations which in turn rely on yet other sets of organisations to carry out their function. Often these links comprise of a few people representing a number of different organisations. In effect, studying an organisation as a single entity makes little sense particularly in attempting to investigate the potential of the very pervasive technologies of our age.

Social perspectives

In order to analyze this phenomenon it is worth exploring social considerations. Alfred Khun and Robert Bean, suggest that a social system and an organisation are synonymous terms: "the production of joint effect by two or more persons" is, they claim, a definition of organisation as it is also the definition of a social system provided that the joint effect of the interaction is greater than the sum of the effects on the participating individuals. A key feature of their work is that a social system and organisation are synonymous. Whenever two or more persons interact, they fill the definition of a system. If the interaction produces no noteworthy joint effect that is greater than the sum of the effects on the participating individuals, the interaction is regarded as simply an interaction, not a system in its own right. However, if some additional result that seems worthy of attention does come out of the interaction, the interaction may properly be construed as a system. Thus, the production of a joint effect is what makes an interaction a system as well as an interaction (Khun and Bean 1983).

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The above view suggests that organisations may be seen not as separated well defined entities but as social systems. Thus any interaction in which there is the production of joint effect by two or more people is regarded as an organisation. Needless to say, this definition is not only prone to ambiguity but is also a very general basis upon which to build an understanding of communication and the infrastructure. At the same time it has the potential of providing a basis upon which we can analyze human networking, the patterns that emerge, and the capabilities afforded by electronic networking. However, traditional theories of organisation allude to formal elements of authority, and responsibility. These are seen by organisational analysts as the formal basis upon which communication relations among members are deemed to be useful and productive. To this, Khun and Bean (1983, p17) add that:

.. Once a larger pattern of joint effect is identified, it does not matter whether the relationship is called social organisational or both.. if the actions of two or more parties are consciously coordinated towards joint effect, the organisation is formal. It is informal if the joint-effect is produced without conscious coordination.

In their view, formal organisations may be regarded as units and interactions that may be analyzed in terms of communications and transactions with other systems or among sub-systems. An informal organisation may neither act as a unit or interact as one. However, we can see that parties engage in self-orientated interactions that, when repeated many times or across many parties, take on a definitely patterned collective result. The development of competitive market equilibriums and of social norms are conspicuous examples. No one plans those patterns, and the parties do not consciously coordinate their actions to produce them, but the patterns nevertheless happen - and that is the essence of informal organisation.

In similar vein, Peter Checkland provides us with the notion of "emergent properties of the interaction of two or more people" (Checkland 1984). In other words, communication relations may be seen to bring about emergent properties. This serves as yet another

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building block towards the construction of an understanding of the human network and its relation to its electronic complement. In remaining consistent with the view of Khun and Bean, and the premise of systems thinking, one can view this complex web of social structure as being composed of layers of interaction that give rise to new forms of interaction at successive levels. Like the systems within which they arise, these interactions are systemic in nature but functional in purpose: they are systemic in that they arise as a consequence of a series previous of related interactions and functional in that they contribute towards achieving a particular or series of purposes translated into projects or activities.

Summary and conclusions

In this chapter it is apparent that the concept of an organisation is built around some very distinct assumptions about the nature of the work processes, the role of the work force and of the uses of information. The changing pressures on organisations have forced a rethink of these traditional notions. This change in perceptions is highlighted in the current thinking on organisations, known as contingency theory. In attempting to fathom why organisations differ in so many respects, contingency theorists came up with the simple answer that organisations reflect their environments. Flexible, organic structures are more appropriate for organisations operating in uncertain environments while more rigid, mechanistic structures reflect the needs of organisations operating in certain environments. In response to this, management theory and practice have chosen to concentrate on designing the basic components of organisational structures.

While the relationship between information technology and organisational structure is the subject of many debates, it is clear that technology does effect the way in which work is carried out. Information systems research has been quick to accept this fact but is still in the process of struggling with its more reductionist, scientific roots. However, information systems research and development methodologies have often indirectly contributed to facilitating and supporting the problem solving, decision making and also learning mechanisms in organisations. It is then not surprising that as interpersonal communication transcends beyond organisational boundaries, there is the need for a

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modified perspective on organisations. It is suggested in this chapter that organisational concerns and the contribution of information systems research and practice be viewed in a broader way, using social perspectives. In doing so, it hoped that the networking phenomena can be more appropriately studied.

For us, truth is made up of many bits and pieces of reality. The flux and change is of essence. Change is so major a truth that we understand process to be the essence of things.

Jane Jacobs

Chapter Four:

Tools and Techniques for Exploring Network Structures

Chapter Four: Tools and Techniques for Exploring Network Structures

Introduction

In this chapter a set of theoretical constructs are presented and developed further for the purpose of investigating networks. These constructs are derived from essentially two theories. The first, structuration theory is used to provide an understanding of social processes and hence the dynamic context within which networks develop. The second, social network analysis, also known as structural analysis, is used to inform an empirical analysis of patterns of relations and network structures.

The research described in this dissertation, uses structuration theory as a basis for epistemology, as a sensitizing device in that it sensitises the researcher to a view of social structure that is created in the minds of human actors and can be understood in terms of concepts, procedures, assumptions, values and norms. Structuration theory is presented in this chapter as a way of exploring social structures. The analysis of networking phenomena is conducted using structural analysis, also known as social network analysis as it provides a set of serviceable theoretical tools with which to analyze networking phenomena. It provides a means of generating empirical evidence based on interpretations of networking. Social network analysis takes the social context as a given and proceeds towards building representations of network structure. Using these representations of network structure it is possible to construct explanations of why people behave in the ways that they do.

The view taken by this research is that social reality is a very complex phenomenon and cannot be captured in its entirety or measured in any quantitative way. However, there are aspects of social reality developed in the minds of people that can be observed and described without overlooking their complexity and vagueness. This research does not propose to quantify or evaluate observations in any way that imposes certain predefined criteria on a social setting or explain everything with one, general all embracing theory. It proposes to develop an understanding of network structure by going beyond the methodological guidelines of structural analysis and its positivist underpinnings, towards a more interpretivist view of network analysis.

Tools and Techniques for Exploring Social Structures

Exploring Social Structures

It is worth exploring the social context as it defines the nature of interpersonal interactions, the behaviour of these interactions and the structure within which the social processes occur. It is useful to consider a social system as "a mixture of a rational assembly of linked activities (a human activity system) and a set of relationships such as occur in a community" (Checkland 1981 p.121). In remaining with this definition, it can be deduced that any group or community whose members accept various responsibilities as a result of their membership, can be considered to be a social system. Similarly, individuals may be seen as members of a rational order of relationships. Robey and Orlikowski (1991) speak of social systems as:

Exhibiting structural properties that are produced and reproduced through the interaction of human actors, rather than as having structures. But individuals do not enact structures in a vacuum; they call on the structural properties that were enacted in the past by prior human action (their own or that of others). In this way, the structural properties established by prior human action come to define and shape individuals' interaction, which in turn recreates the social properties anew. Conceiving of structure in this way acknowledges both its subjective and objective features.

The interaction of human actors within a social context is increasingly becoming a concern of information systems theorists; it has the potential to bring about an understanding of how and in what ways information processing has affected and is being affected by its surroundings. The notion that there are certain structural properties in interpersonal interaction, brings about the possibility of being able to describe these interactions.

Wanda Orlikowski (1992) explains that the technological imperative can become a product of the social practices that evolve around the use of a technology. She writes of a software consultancy company that instituted productivity tools for the development of information systems. These tools were intended to standardise the systems development

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work of its consultants and were based on the systems development knowledge and norms that they had accumulated through the life of the company. Commissioned by senior management and developed by technical consultants the tools were deployed on project teams. With the use of these tools, screen designs were automatically generated. On the one hand, this enabled consultants to design screens faster but on the other hand, the tools restricted the consultants to the formatting options available in the tool's repertoire. Because of the institutional pressures compelling the consultants to use the tools, the consultants were forced to persuade clients to use the screen formats that had been generated by the tools.

This case is not an isolated event, but does point to an increasing awareness that the software tools and techniques employed for the development of information systems, are in fact determined by management prerogatives. These prerogatives, translated into operating procedures, have the effect of determining social action. By attempting to control the outcome of systems development procedures, management practice had, in the case reported above, indirectly contributed to shaping action and hence social structure. The creation of social structure in this respect was not restricted to the way in which the consultants carried out their work, but also to the way in which the clients ended up using the software.

This condition can perhaps be explained by structuration theory, which sees social life as structured practices. Its major treatise is that every action bears a dual relation to structure in that every action produces and reproduces structure. Speech embodies structure and translates into meaningful human action; this is known as the production of structure. The reproduction of structure involves a series of speech episodes that contribute to the development of more general social structures such as *language* or *class domination* (Galaskewicz 1976). Berkowitz (1982), explains that a number of researchers who study the transformation of the structure of certain types of groups refer to this process as structuration. A particular, important insight of Giddens' theory of structuration is the theorem of the duality of structure (Giddens 1984):

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"According to this notion the structural properties are both medium and outcome of the practices that they recursively organise. The social systems in which structure is recursively implicated comprise the situated activities of human agents, reproduced across time and space. Analyzing the structuration of social systems means studying the modes in which such systems, grounded in the knowledgeable activities of situated actors who draw upon rules and resources in the diversity of action contexts, are produced and reproduced in interaction."

Although human action is constrained and enabled by social structures, these structures are the result of the combined actions of human actors. Giddens explains that human actors bring with them a set of rules, and knowledge in their social encounters. Combined human action brings about patterns of interaction that then become established a standardised practices. Communication, according to Giddens is a general element of interaction; it is also the basis of culture. The process of structuration or the transformation of meaningful human action, is interpreted by Giddens as a staged process that has to go through signification, domination and legitimation. *Signification* is when embedded knowledge (concepts, procedures) directs the manner in which problems are interpreted and work is carried out. *Domination* constitutes resources which are deployed in order to control work processes. Through in-built assumptions and standardised procedures, these resources exert unobtrusive control over the nature of work and the coordination of activities. *Legitimation* sanctions a particular manner of work or pattern of behaviour, and propagates a set of norms about what is acceptable social practice. It can be seen as the institutionalisation of a particular course of action where a shared reality producing predictability and uniformity in thought and behaviour is brought about. When a particular work process is legitimised, it develops a basic language and norms of action that allow human actors to have the same conceptual appreciation of it. In such a situation, people can easily be substituted on the work process (Giddens 1984).

The duality of technology as posed by Orlikowski, allows us to see technology as enacted

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by human agency and as institutionalised in structure. The structurational framework provides us with a means of investigating not only the movement of technology through time and space, but also across organisational boundaries, potentially providing the basis for analyzing interorganisational relations of learning, influence and dependence. Orlikowski explains that many technologies used by organisations today are not built internally, often a technology may be designed by one organisation, built by a second, and transferred into a third for use (Orlikowski 1992). The main contribution of structuration theory as explained by Walsham (1993), is "not in its conception of either action or structure, but in its reconciliation of the two levels in the *duality of structure*". It makes the link between context and process and lends itself well to be used as a *meta-theory* within which research on action and social structure can be discussed and located. In addition, Geoff Walsham (1993 p.70) suggests that:

Structuration theory offers a subtle and detailed view of the constitution of social life, but the analytic dimensions of the duality of structure and its associated modalities could be considered as too detailed and complex for empirical analysis in some instances.

The theory of structuration and its framework of production and transformation of social structure provides us with insight into the social processes that take place in the creation and development of patterns of relations. Geoff Walsham³ provides an example of how structuration theory may be used as a sensitizing device: the fall of communism was the result of structures in people's minds that attempted to bring down authority. This shows how structures in the minds of individuals and linked structures in a number of people's minds may be used to subvert existing structures. Structuration theory does not suggest how this insight may be used in a way other than to explain its own treatise. It is more of a *meta-theory* that informs the use of a chosen theory or method. According to Geoff Walsham, there are three ways in which structuration theory may be used:

³ Personal communication, Cambridge November 1994.

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- 1. To provide illustrations of how certain concepts may be used to illuminate research.*
- 2. As a basis for epistemology. Structuration theory has a great deal of implicit epistemological views relating to action and social structure; it enables the researcher to investigate this in relation to the process of change.*
- 3. As an epistemology. The researcher looks for actions and structures over a period of time and writes up results in structuration theory terms; this is the most contentious use of structuration theory. The researcher may analyze every act as an opportunity for reproduction but risks becoming mechanical and using jargon words.*

By using structuration theory as the basis for epistemology, it is possible to define networks in terms of signification, domination and legitimation. However, structuration theory does not provide any support for empirical analysis. And yet, for the purpose of gaining insight into the nature of a network, it is necessary to obtain empirical evidence to illustrate network structure and behaviour. This requires tools and techniques that enable a more pragmatic analysis of network structure. There is a body of knowledge in social science, known as structural analysis (also known as social network analysis), that provides us with a rich theoretical base upon which we may qualify patterns of relations among human actors, organisations and social units.

Social Network Analysis (Structural Analysis)

Investigating social processes, the formation and destruction of links between people and institutions has been a theme of a number of disciplines ranging from mathematics to social science. In social science, social network analysis or more formally, structural analysis, takes the idea of a regular, persistent pattern in the behaviour of the elementary parts of a social system, and uses it as a focal concept for understanding social life. The objective of structural analysts is to recognise patterns in social phenomena and create

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models that are analogous (ideally isomorphic or homomorphic) to the phenomena that they are seeking to capture. Their goal is to uncover the essential form of observable events or processes (Berkowitz 1982).

Over decades of research in small communities structural analysts have found patterns of relations from which they have developed a set of concepts aimed as a guide to interpreting such social processes (Thompson *et al* 1991, Berkowitz 1982). Endeavouring to interpret interpersonal ties can become a very difficult task especially as the interpersonal networks being investigated are highly transitive. Social scientists have often been frustrated while searching for specific small scale structures with these networks. Despite the difficulty in representing structure, the notion of structure came to be identified as a means of interpreting observable reality. In the 1950s and early 1960s social scientists borrowed the simple network from graph theory and began using it as a means of describing the relationships between people, family groups, corporations, government offices, and the like. At first, networks were employed as little more than metaphors for the things social scientists were trying to deal with. This had the effect of encouraging researchers to think of social systems and social processes in terms of relations between constituent parts, more interestingly, network-based models forced social scientists to view emergent systemic phenomena in their own right.

The social network concept arose during the early to mid-1960s as the formal analytical and descriptive phenomenological research traditions came together. This advocates the idea that social structure is best understood in terms of the dynamic interplay of relations between and among persons on the one hand, and the positions and roles they occupy on the other. Reversing the conventionally accepted logic of inquiry in social science, structuralists came to argue that social categories and bounded groups could best be discovered by examining the relations between and among social actors and institutions. Advocates of this concept postulated that one should begin with a set of relations and from them derive a topology and map of the structure of groups (Berkowitz 1982). There was a consequent shift in focus away from the individual towards an examination of systems linkages between and among organisations or groups. In the late 1970s inferences

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were drawn about interorganisational links and resource networks from graphs in which organisations are represented as nodes and people as relations between them. This meant that the unit of analysis came to encompass groups of people. There emerged the notion of a 'collective actor' consisting of a cluster of individuals sharing, but not necessarily acting in terms of a set of common orientations towards an issue.

The question of social linkages and their effect on organisational transactions is described by Galaskiewicz (1976) in a study of interorganisational linkages within a small community. Money, information and support were addressed by this study as the dimensions of interorganisational exchange. After a series of interviews, graph theory was used to map networks of money information and support among the seventy three organisations in a community (these included banks, factories and shops) investigated by Galaskiewicz.

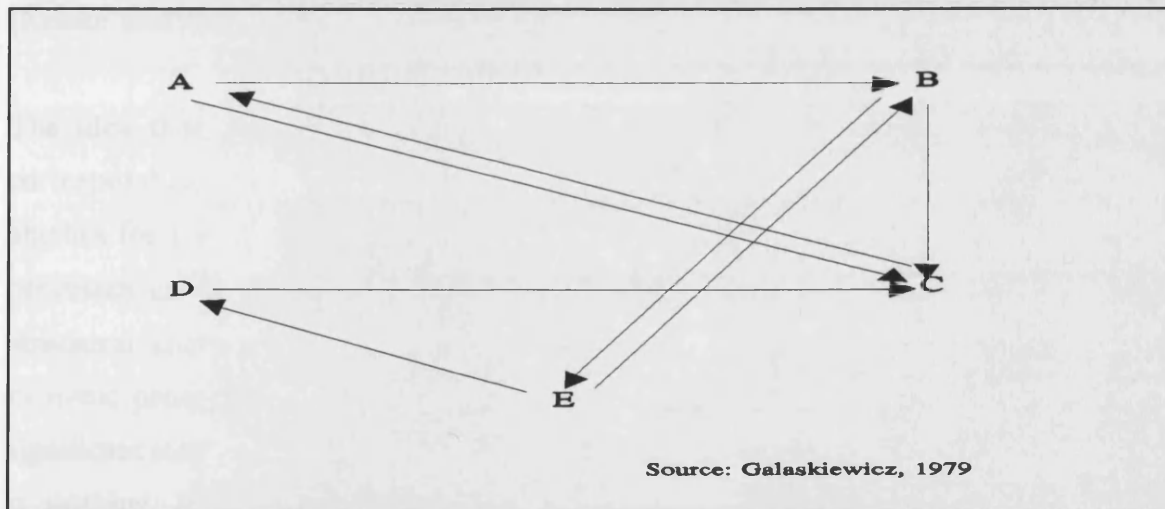


Figure 1: Sociogram with five actors

In this study, the structural relationships among social units were constructed by asking each member of a group to identify other members with whom they were friends. The resulting sociogram or a set of relationships within the groups (illustrated in figure 1) was then mapped in a two dimensional space using points to represent the individual actors and arrows to denote the directions of friendship choices. Each actor is represented by

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a 'point' and its relationship with another actor is represented by a 'line'. The direction of the arrow indicates whether an actor gives a particular resource to another or receives it from that actor.

Structural analysis is a useful means of representing observable reality. In particular the idea that there are certain generalised relations among parts of a social system. These are demonstrated by an interesting contribution of the notion of linkages between individuals or institutions and how these may be used to describe a set of relations. A typology of these relations is developed and mapped to illustrate structure, while the concept of homomorphism (many to one mapping) is used to compare structures. The purpose of this type of representation is to identify the significant positions within a given network of relations that link a system of actors. It focuses on the social structure of a system which is the regular patterns of relations among the positions composed of concrete actors which may be people, organisations or even national governments (Knoke and Kulcsinski 1982).

The idea that generalised relations among parts of social systems can be shown to correspond to what is implied by the mathematical concept of a group, led to the use of algebra for the exploration of social structure. In expressing the very undefined social processes using strict mathematical notation, the richness of social reality is lost and structural analysis tools and techniques became ill adapted to expressing change and dynamic processes. The process of capturing structural linkages in social reality is a significant step towards obtaining an understanding of the social context within which one is working. In concentrating their work on identifying regular patterns of relations, structural analysts have not had the possibility to consider the impact of environmental changes on the patterns of relations. For example, in the insightful study carried out by Galaskiewicz (1976), it is not possible to distinguish how the linkages in the small community would be affected by the introduction of a new factory representing a change in the trading relations of all the other actors in the community.

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Examining Networks

A notable contribution of structural analysts has been in describing the different types of interpersonal interaction that take place within social systems. The notion that there are certain generalisable patterns of relations in social systems and that these may be identified in a number of different social settings is useful. Although traditional network analysis has evolved within a highly positivist tradition that attempts to define concrete entities and evaluate these in terms of attributes and relations, the concepts that have been developed can be very valuable to interpretivist research. At the core of structural analysis is the notion that social networks may be analyzed by conceptualising and structuring social relations to make them more understandable. In remaining consistent with this view, Burt (1983, p.9) provides us with the following definition:

..the research of social environments of people, groups, or formal organisations (actors) is at the heart of network analysis. Social environments are conceptualised and studied in network analysis as a structure of relations among actors in an environment. Actor attributes and behaviours are then explained in terms of the structure of relations in which they occur.

Knoke and Kuklinski (1982) state that network analysis is about the nature of relationships that a given person has with other members and it is also about patterns of relations among concrete entities within a social system. A network is defined as a specific type of relation linking a defined set of persons, objects or events. Different types of relations identify different networks even when imposed on an identical set of elements. The set of persons, objects or events on which a network is defined may be called the actors or nodes. Network analysis must take into account both the relations that occur and those that do not exist among the actors. For example, considering only the advice-giving network in an organisation, but not the key actors that are absent from this network, may give a distorted picture of the decision processes (Knoke and Kulksinki 1982).

Structural analysts like Knoke and Kulksinki (1982) propose that various aspects of the

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social world may be approached according to their attributes and their relationships. This view accords with the data modelling perspective familiar to the information systems community. In particular, the network model of data as described by Chen (1978) provides a natural view of data that separates entities and relationships, but its capacity to achieve data independence has been challenged. Many aspects of social behaviour can be treated from both attribute and relational perspectives. Attributes (intrinsic characteristics of people, objects or events) may be involved in relationships that exist only if two or more entities are considered together, but a relation is not an intrinsic characteristic of either party, but is an emergent property of the linkages between the units being observed. As Knoke and Kuklinski (1991) explain, relations are the building blocks of network analysis. A relation is taken to be an emergent property of the connection of the links between units of observation and exists only if two or more entities (classified as persons, objects and events) are considered together.

Most network analysis techniques produce a description of patterns of relationships. Some of these may be seen to demonstrate symmetry whereby a symmetric relation has no direction; it involves a two way exchange of communication. An asymmetric relation is a one way arrangement whereby if B is related to A does not necessarily mean that A is also related to B. The communication process is one way. Other relations demonstrate transitivity. Transitive relations are about who gets to know a certain piece of information. A relationship is transitive if, when A is related to B and B is related to C, A is also related to C. For example, if A has authority over B and B has authority over C then if a relation is transitive, A also has authority over C. Similarly, in a transitive relation, information passed from A to B reaches C without A and C having communicated. This concept is also used to measure the distance between links (Richards 1985). The configuration of present and absent ties between the actors in a network reveals a specific *network structure*. Network structures vary dramatically in form from the isolated structure in which no actor is connected to any other actor, to the saturated structure in which every actor is directly linked to every other. A central premise of network analysis is that the structure of relations among actors and the location of individual actors in the network have important behavioural, perceptual and

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attitudinal consequences both for the individual units and for the system as a whole. This means that the structure of the network, defined by its attributes and relations, influences action not only of the individual actors but also the actions of the actors as a whole.

It is useful to use this form of analysis to explore the extent to which the influence of the institution or a set of institutions to which the human actors are connected, and may contribute to the development of network structures. Although networks based on similarity of structural position also tap social influence (Rice and Aydin 1991), structural networks by their nature are not valid indicators of social influence; the theories upon which social influence processes are based clearly propose a relational rather than structural approach (Fulk and Boyd 1991). In view of this we need a way of investigating the relational properties of networks.

Social Network Concepts

The theoretical concepts drawn from structural analysis can be used in a an interpretive manner, in particular, to describe the structural properties of networks. These concepts have been developed from extensive observations of social phenomena and are intended to serve as tools to guide the observation and interpretation of the networking phenomena investigated in this research. The concepts that are employed for the purpose of analyzing network structures in the case study investigated in this research, are as follows:

- ***Relations***
 - stratification*
 - range*
 - connectivity*
- ***Measures***
 - prominence*
 - centrality*
 - prestige*
- ***Models***
 - hierarchy versus centrality*

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cohesion versus structural equivalence

- *Approaches*
 - positional*
 - relational*

Relations on a network may display properties of *stratification* in which the researcher observes that there are a few actors involved in many relations. In addition, there may be certain relations on the network that enable resources (information, money, and expertise) to be accessed from other networks. This means that the network displays *range*. Relations may also be defined according to the number of communication relations that exist among a group of actors on a network; this is known as *connectivity*. A theoretical construct that is very popular amongst structural analysts for measuring relations is known as *prominence*. They believe that actors on a network may be prominent in that they are active in directing relations, measured in terms of *centrality*, or they may be the object of extensive relations, measured in terms of *prestige*.

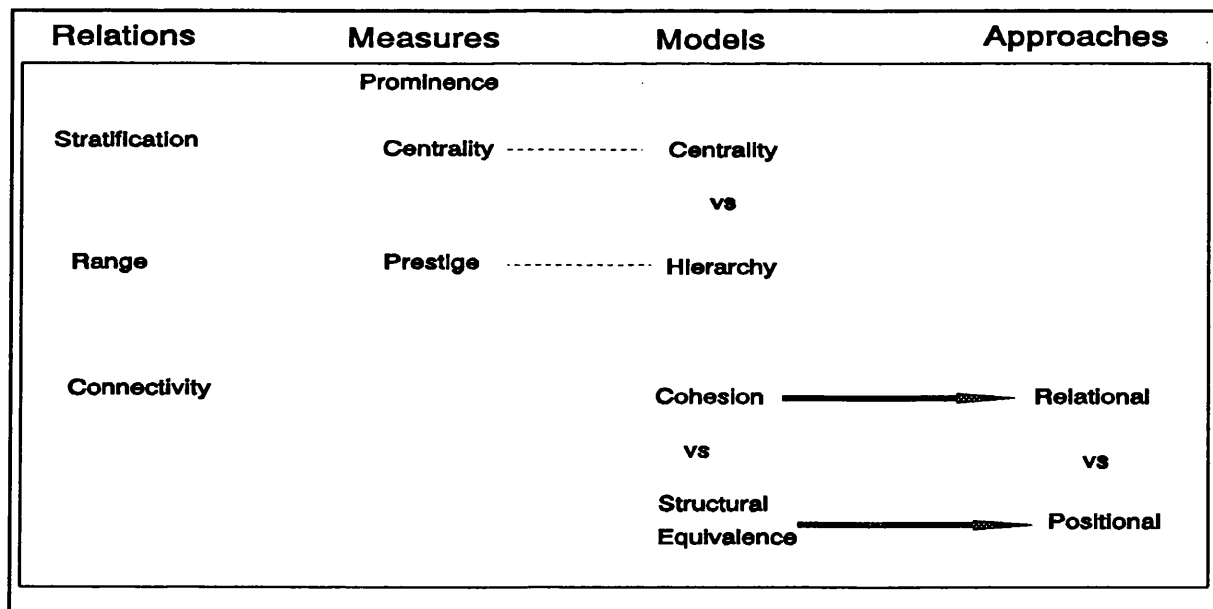


Figure 2: Social Network Concepts

Models of network structure may then be used to qualify observations and data collected

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about individual actors. Models of *hierarchy versus centrality* can be used to put into perspective the hierarchical relations measured in terms of prestige as opposed to relations that describe coordination of actors and activities defined in terms of centrality. Models of *cohesion versus structural equivalence* enable the distinction to be made between the relations among actors observed on a network and the positions that they occupy. The study of networks from both these perspectives is guided by two approaches: the *relational approach* which focuses on relations among actors and the *positional approach* which focuses on their attributes.

Within the interpretivist strategy of this research, these theoretical constructs are used in a qualitative manner. They are presented in the following sections as a means of identifying the network properties of a group of actors. It is up to the researcher to assess the appropriateness of these concepts for a given set of circumstances. An illustration of these concepts in relation to each other is given in figure 2. These concepts are considered further in the following sections.

Stratification

The structure of a network is described by structural analysts as exhibiting patterns in the relations among social actors. The concept of stratification is used to depict asymmetry in a pattern of relations. According to Thiel's (1967) Information-Theoretic concept (explained in Knoke and Burt 1983), a network is stratified to the extent that there is no disorder in its relations. This means that relations are disordered to the extent that all actors are equally involved in them. When a network is stratified, all the actors are involved in relations but there are a few actors who are involved in the most relations. As described in figure 3, a highly stratified network displays an asymmetric structure in which a few actors are involved in many relations and

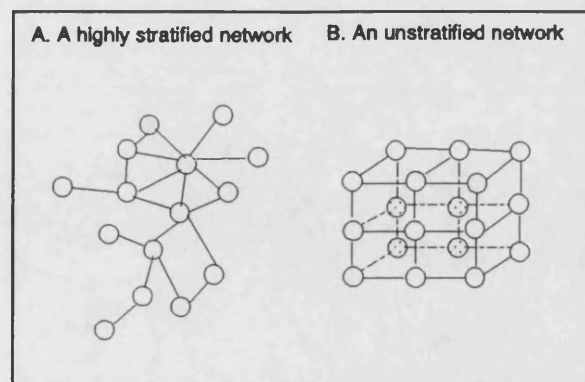


Figure 3: Stratification

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an unstratified network all the actors are equally involved in relations. The structure of an unstratified network is similar to that of a formally defined matrix organisation whereas a stratified network structure is more representative of an informal advice seeking/giving network.

Stratification can be used to describe the extent to which all relations in a network involve a single actor or it can be used to describe the extent to which a single actor is the object of all relations. Often it is the case that a network is stratified to the extent that there are a few actors who are

actively involved in many relations (Knoke and Burt 1983). As is illustrated in figure 4, the structure of the network is stratified according to the relations in which actors A and B are prominent. In a case by Burt (1983), described below, of the Galesburg physicians it was found that the physicians are clearly stratified in the

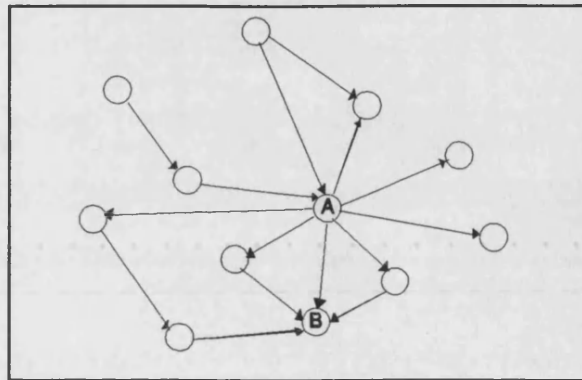


Figure 4: A Stratified Network

sense that there were a few prominent physicians involved in many relationships.

For the purpose of analyzing the data gathered in this research, stratification in a network is useful in ascertaining the structure of a network of relations. This can be ascertained by asking how many actors are involved in extensive relations ?, to whom are these relations directed ? and what sort of communication relations are there ?

Range

The concept of range is used to describe the extent to which certain prominent actors in a network, called egos, are connected to other prominent actors in other networks. This is argued to be a concept that has more than one dimension because of the many different types of networks that are seen to be related to the *ego network*. An ego network is simply a depiction of a number of actors connected to a particular actor called and ego. This theoretical construct is used by structural analysts as a measure of

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access to resources. As depicted in figure 5, the ego network is represented by the black dots connected to the ego (E). The range of resources that the actors on the ego network have access to is illustrated by the involvement of some of the actors in networks S1 and S2.

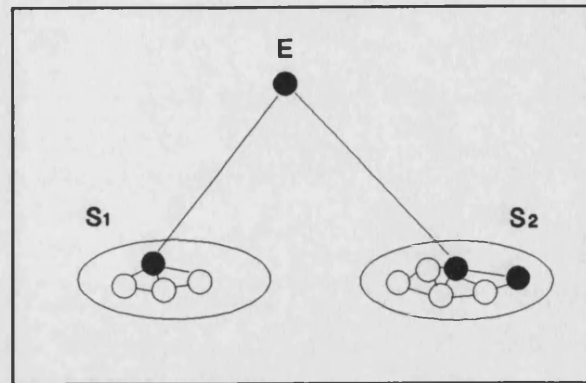


Figure 5: Range

In a social environment that is stratified into status groups, the greater the number of status groups to which the ego (E) has access, the greater the diversity of information and social support to which he has access. The number of status groups to which the ego (E) has access to is the first measure of range. The second measure of range is the number of different status groups represented by those connected to the ego (E). The range of the ego's (E) network is not increased equally by each of his or her contacts as much as it is increased by the quality of contact. With respect to network range, a contact has quality to the extent that it increases the diversity of black dots (known as alters) on the ego's (E) network. In the case of a senior surgical consultant (E) of a reputable hospital, one will find that the ego network is comprised of similarly prominent actors such as consultants and registrars in other hospitals. The resources that the senior surgical consultant has potential access to by way of his ego network is indicative of range. His range may be increased by the extent to which the consultants or registrars on his ego network may be connected to other consultants or registrars in different hospitals.

Connectivity

Connectivity is measured by the number of actors directly connected to the an individual; it is also known as reachability. A direct connection is when an actor has access to another without having to go through an intermediate actor. This concept describes the strength of an actors relations represented by short chains of connections to all actors in a network. This concept is related to range in that prominent actors can be seen to maintain a small number of direct contacts through which contact is maintained

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indirectly with a large number of actors. In the case of a hospital, doctors are seen to maintain direct links with each other for, amongst other things, purposes of consulting each other on patients diagnosis.

Prominence

The concept of prominence is useful in assessing the extent to which certain networks are prone to adopting new ideas, knowledge or innovation. An actor (individual, group or organisation) is prominent within a social system to the extent that their relations make them particularly visible relative to other actors in the system (Burt *et al.* 1983). There are two classes of prominence, Centrality and Prestige, that qualify the type of visibility that an actor bears. Central actors are visible because of their extensive involvement in relations while prestigious actors are visible because of the extensive relations directed at them (Knoke and Burt in Burt *et al.* 1983). These indicators of prominence are not interchangeable and are intended to allow inferences to be made about the joint behaviour of the social actors in a network. And yet, they are not mutually exclusive as they can be used to analyze the behaviour of social actors in a network from both of these dimensions of prominence. For example, in a hospital, certain networks can be identified in which there are a series of prominent actors who influence the advice giving/seeking behaviours of a group of actors.

Centrality: In structural analysis centrality is measured in terms of the number of actors linked to a particular actor. This concept defines relations in which an actor that is central to a network is connected to almost every actor. An actor's centrality may be determined by the number of direct connections linking the actor or the extent to which they are

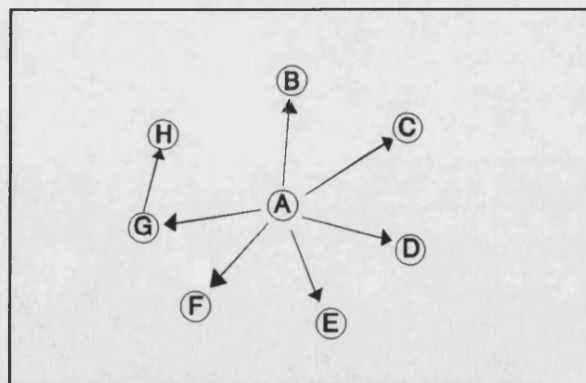


Figure 6: Centrality Relations

reachable through other actors. This concept assumes that prominent actors are those who are extensively involved in relationships. In measuring centrality on a network, one

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must be able to observe the number of times actors communicate with other actors. Actors that direct the most number of relations to other actors display centrality relations. Whether a relation is absent or present is more significant in the flow of information among actors than the difference between the source or receiver of information (Knoke and Burt 1983). In effect, being a provider of information defines a centrality relation. As is illustrated in figure 3, the central actor A conducts relations directly as well as indirectly to H via G. In the example of a network within an emergency ward of a hospital, the centrality relations can be identified among an actor or a group of actors who are involved in referring patients to specific departments (house officers) and reporting the condition of patients and results of treatments (nurses). In this case, both doctors and nurses are performing centrality relations in that they are directing relations to other actors. Centrality is also a measure of the range of an actors relations.

For the purpose of this research, it would be more appropriate to interpret this concept as a means of finding out which are the prominent relations based upon the level of information exchanged. We use the centrality measure of prominence in a qualitative manner by finding out who begins a topic of discussion ?, who provides information to the other actors on the network of relations ?, who directs the relations ? and in effect, who talks the most ?

Prestige: Assumes that prominent actors are those who are extensively the object of relations. Being the source or the object of a relation is considered to be significant here. Prominence according to the prestige perspective is indicative of leadership in that prestige relations describe actors that are the objects of extensive relations from other actors.

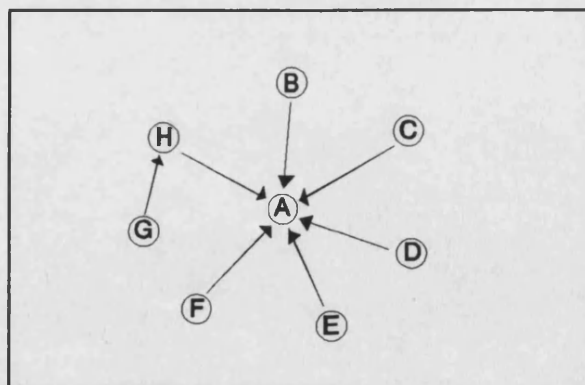


Figure 7: Prestige Relations

Prestige increases with the extent to which an actor is the object of relations, but not

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with the extent to which he or she directs relations to other system members. A particular insight provided by the prestige measure is the extent to which certain actors exercise control over valued resources and authority. This is also an area in which prestige brings about asymmetry of relations and thus a change in the structure of the network. The manner in which prominent actors are involved in relations makes prestige distinct from the centrality (Knoke and Burt 1983). This is illustrated in figure 4. In the case of the hospital, prestige relations can be described by relations in which junior doctors seek the advice and second opinions of consultants and registrars when diagnosing a difficult case. Prestige relations also influence the speed at which and extent to which a group of medical practitioners start prescribing new drugs. If the doctor who is the object of extensive relations (in other words the prestige actor) does not prescribe a new drug chances are that the rest of the doctors on the advice giving/seeking network will not prescribe a new drug.

In a case study carried out by Burt and his colleagues of a group of physicians in Galesburg, it was found that the speed at which medical innovations were adopted was very much subject to prominence. Personal interviews were conducted of 32 Galesburg physicians as part of a study to assess the social factors contributing to the physicians' decision to begin prescribing the new anti-biotic, tetracycline. Physician prominence was described in terms of the network of discussion relations between them. Each of the physicians was asked about who were the three or four physicians with whom they discussed cases or therapy in the course of an ordinary week. The results were mapped on to a diagram showing the links between the physicians and the number of times that they were used. It was found that physicians displaying a high degree of prominence were faster at adopting medical innovation than those who were not very prominent in the community. This correlation was discovered using the prestige measure of prominence. There was no such correlation using the centrality measure of prominence as the decisions to adopt a new drug were based on leaders setting the pace for the less prominent followers rather than on the flow of information among actors (Burt 1983).

In using these concepts to identify the extent to which certain networks are more

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conducive to innovation while others are not, it is worth considering the ways in which these relations are developed and the way in which they become part of the accepted way of working. The emergence of certain actors to prominence may mean that the structure of the network changes to accommodate the centrality or prestige relations. In analyzing the data collected from the case studied in this research, a qualitative use of the prestige measure of prominence can assist in identifying actors that influence the behaviour of the actors in a network. Particular questions such as, whose opinion is sought the most?, who influences the conversation?, and who guides the discussion and decision making?

Hierarchy vs Centrality

Network structure can be summarised in terms of models of hierarchy and centralisation. A network is centralised to the extent that all relations in it involve a single actor. A network is hierarchical to the extent that a single actor is the object of all relations in it. Hierarchy refers to the prestige of positions in a network. A centralised structure of symmetric relations is not a hierarchy. Although both models describe the extent to which a dominant elite is defined by a network and both describe inequality in the extent to which actors are involved in relations, they are not identical. A network is hierarchical to the extent that there are differences in the prestige of actors in it. It displays centrality in the extent to which all relations involve a single actor.

This concept of hierarchy differs from that of systems thinking in which it is the principle according to which entities meaningfully treated as wholes are built up of smaller entities which themselves are wholes (Checkland 1981). Hierarchy in a network is determined by the level of influence or prestige displayed by individual actors. Even groupings of individual actors can only display characteristics of hierarchy to the extent that the group is the object of relations from other networks of actors.

Cohesion vs Structural Equivalence and Positional vs Relational Approaches

The models of cohesion versus structural equivalence relate to two ways of investigating the structure of a network. On the one hand it is necessary to identify the relations that

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actors have on a network. On the other, the attributes defining the actors in terms of the positions that they occupy is also necessary. Knoke and Burt (1983) make the distinction that "where structural equivalence concerns relational patterns, cohesion concerns the intensity of specific relations of those patterns". Cohesion alludes to the ways in which actors interact based upon the relations that they have with other actors on a network. Structural analysis enables the significant positions within a given network of relations that link the actors (which may be individuals, organisations or even national governments) in a social system to be identified. The relational approach is used by structural analysts to guide the investigation of relations. According to Knoke and Burt (1983, p.266):

A relational approach focuses on relations between actors (people, groups, or formal organisations) and aggregates of actors connected by cohesive bond into cliques. Taking a relational approach to analyzing networks would mean that networks displaying cliques or sets of actors with bonds to one another and not to other actors in an network, are cohesive.

An understanding of the degree of cohesion in a network is largely a subjective evaluation based on the perceptions and observations of the investigator. The degree of cohesion in a network is an indication of the strength of the links that connect the actors in a network. A more valuable outcome of using the relational approach to investigating a network, is that provides an indication of the coalitions and shared interest groups. In particular, an insightful analysis can be made of the collective power of the actors and the influence that they have on other networks.

Positions, or social roles, are subgroups within a network defined by the pattern of relations (which represent observable behaviour) that connect the actors together. Structural analysts maintain that regular patterns of relations among the positions composed of concrete actors constitutes the social structure of a system. The positional approach provides insight into the structural properties of network. Jointly-occupied positions identified using this approach are the positions defined by patterns of relations

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between actors.

A positional approach focuses on the pattern of relations in which an actor is involved and aggregates of actors with similar patterns (ie structurally equivalent actors) into jointly occupied positions. This approach to analyzing networks provides a basis for identifying patterns of behaviour between actors within a network.

For example in a hospital system, the positions of doctor, nurse, patient, or administrator persist despite frequent changes in the individuals occupying these positions. New positions may be created when an actor establishes a new set of relations to the existing positions. This happens, for example, when data-processing specialists are hired to manage the diagnostic and administrative flow of the hospital (Knoke and Kulksinki 1991). Although an identification of positions is a necessary step in network analysis, it is however incomplete unless there is an appraisal of the relations connecting the positions to one another (Knoke and Kulksinki 1991). In deciding on the basis upon which approach to use when identifying the positions in a network and to determine which actors occupy each position, structural analysts have the choice of considering social cohesion among actors, or they may chose to examine the network using structural equivalence. These concepts are familiar to information systems people who are accustomed to designing software along the principles of cohesion and coupling. The tenets of modular design suggest that where there is high cohesion in the modules there will be low coupling with other modules and vice versa (Pressman 1987).

Knoke and Kulksinki (1991) explain that social cohesion is when actors are aggregated together into a position or 'clique' in that they are directly connected to each other by cohesive bonds. Structural equivalence on the other hand, is when actors are aggregated into jointly occupied positions or roles to the extent that they have a common set of linkages to the other actors in the system. In a network with a high degree of structural equivalence, the structure of the network is not changed every time there is a change in the person occupying a particular position. This is not the case in a network where there

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is a high degree of cohesion among members. When there is a high degree of structural equivalence, one can expect the structure of a network to be the same as the structure of another or a number of networks which contain the same or similar positions (as is in the case of Hospitals). This makes it easier for people in one network to move to another without making much of a difference in the structure of either of the networks. In effect, some structural analysts contend that in a network where there is a high degree of structural equivalence there is very low cohesion (in Knoke and Burt 1983).

Applicability of Network Analysis

The application of structural analysis concepts for developing an understanding of the social processes that influence the design and development of information systems opens up a range of possibilities. In particular, it guides the selection of the types of information technologies that may be developed within certain social conditions, and how these may support particular patterns of relations. However, the complexity and ambiguity inherent in any system or pattern of interpersonal interaction calls for a more interpretive approach towards the development of information systems. In the case of research in computer mediated communication, an approach that enables context specific hypothesis to be developed rather than generalisable hypotheses, and that the process of hypothesis testing to be an iterative one of clarifying the conditions upon which the hypothesis is supportable, is required (Fulk *et al* 1992).

In considering the applicability of networking techniques we must recognise that there are certain network structures that reoccur in various social settings. These may be built up to model the relations between actors. The network structures are a useful guide to understanding the ways in which networks may develop and perform certain functions. Whereas some networks may be easily constructed or reconstructed to perform certain activities, it is also the case that other types of networks are not as amenable to being developed. Often, as is the case with most social processes, networks develop over time as relationships develop and interpersonal interactions change. The learning processes have a significant impact on how the networks respond to certain events. Elements of network structures that can be represented using the network analysis concepts described

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above are those of collaboration, power and control.

Collaboration

Sustained links between people and organisations are often developed over a period of time and bring about possibilities for mobilising the collective effort of people in a number of interrelated departments, organisations and groups of organisations. A common ground may become established in which accessing resources and obtaining relevant expertise is part of an ongoing tradition of collaboration. The concept of centrality, is particularly useful in considering the value of the collective efforts between individuals involved in a collaborative initiative. In his studies of power networks, Galaskiewicz (1989) determined that an organisation was central if it had linkages or interorganisational relationships with several other actors in the system. The major empirical findings of Galaskiewicz (1979) and Knoke (1983) were that organisations that are more central in community-resource networks were seen by other community actors as more influential in community affairs, better able to achieve their goals, and were more likely to become activated on community issues.

Activation, explains Galaskiewicz (1979), is being at the centre of resource networks. This gave organisations he studied, access to a greater number of other organisations that could provide them with the necessary resources. Because the likelihood of mobilising resources is much greater for actors in the centre of social networks, they could more confidently engage the political process - the process of influencing other actors and mobilising resources for collaborative initiatives. In addition, Knoke (1983) found that by cultivating diversified ties to large numbers of community organisations capable of supplying resources, a group's dependence on a single source can be significantly reduced.

Power and Control

Galaskiewicz (1989) argues that organisations maintain certain networks of overlapping memberships between themselves and key organisational actors in order to extend their control over valued information and other resources. The purpose of such a network is

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to provide information to the organisation by attempting to tap into the assets of other organisations by mobilising their own members or directors who belong to these other organisations as well. He claims that politically active organisations would gain access to politically relevant resources through their members and directors. A central assumption in the work of Galaskiewicz and his colleagues (1979, 1989) is that if organisations do not have the resources they need, they will secure these resources from other organisations. Galaskiewicz (1989) contends that an organisation's existing set of interorganisational ties can act as a conduit through which the resources can be secured which, in turn, enables it to achieve its goals. Although these interorganisational relationships may not have been established with this purpose in mind, they nonetheless could be useful in procuring resources. He adds that the power of an organisation is a function not simply of its own resources or control over significant events, but also of its potential to access resources of other organisations in the community; central actors have the power to mobilise resources that other organisations control. In similar vein, Perrucci and Potter (1989) describe the creation of industrial networks based on the power relations among directors.

This argument of acquiring power through corporate networks is very much akin to Rosabeth Moss Kanter's (1988) studies that illustrate how mobility of certain individuals in between parts of organisations and to other organisations serves as a mechanism for building up the power of certain groups and individuals. Elements of cohesion within a network relative to that of another may provide an indication of the extent to which power and control is potentially exercised over the collective resources of a particular network. Sometimes, looking at the positions on the network may provide an indication of the type and level of authority that actors occupying certain positions possess.

Summary and Conclusions

In this chapter two theories were developed according to an interpretivist research strategy. Structuration theory sees social life as a structured series of practices, and social network analysis (also known as structural analysis) proposes that there are certain generalised relations among parts of social systems. Structuration theory can be used to

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study the vague and complex structuration process and social network analysis to focus on an empirical analysis of patterns of relations. In combining structuration theory and social network analysis to analyze behaviour on a network, a process orientated view is combined with a more static representation of network structure.

Examining networks using concepts from social network analysis requires an investigation of relations among actors as well as positions that the actors occupy on the network. This means that while considering the roles that people occupy, their combined relations in terms of connectivity, range and stratification can also be considered. This research distances itself from the explicit notion of measurement in social network analysis and uses concepts in a qualitative way to evaluate prominence in a network. In combining both static and dynamic techniques to investigate networks within an interpretivist research strategy, this research has the capability of addressing sustained linkages between people and organisations through time, control over resources in different organisations and influence over action (activation).

No piece of information is superior to any other..There are always connections; you have only to want to find them.

Umberto Eco

Chapter Five:

A Study of The Commonwealth Network of Information Technology for Development (COMNET-IT)

Chapter Five: A Study of The Commonwealth Network of Information Technology for Development (COMNET-IT).

Introduction

This chapter presents a simple account of the Commonwealth Network of Information Technology for Development (COMNET-IT). This is a network of people and organisations who are involved in various activities such as supporting the development of electronic communication linkages, running workshops and providing electronic conferencing and consultation services. This network may be seen as a collection of actors who share sets of common goals and have access to a variety of resources and who mobilise these to accomplish joint initiatives. COMNET-IT can also be seen as a mechanism for coordinating geographically dispersed activities.

The description of COMNET-IT and its projects is given from essentially two perspectives. Firstly, the official view of the way in which COMNET-IT develops and operates. This view is supported by project documents, workshop reports and international agency publications. The second is the more discursive perspective of the researcher. This is supported by surveys, informal interviews, research papers, conference proceedings, and observations. Much of the material described in this section was collected while the author was working as the coordinator of COMNET-IT.

This chapter begins by providing a description of the initial goals for an initiative that was to take the shape of COMNET-IT as they were drafted by the Commonwealth Heads of Government (Menon Report 1985). It then goes on to give a picture of the loose, dispersed structure of COMNET-IT and how it operates. COMNET-IT's origins, evolution, primary projects and activities are described. In this context, two electronic networking initiatives are considered in greater depth. These are the Informal Consultative Group of Information Technology for Development and the GOVERNET network. The chapter concludes by isolating salient features of networking raised by the cases studied, and compares these to similar initiatives at each of the five levels of networking.

A Study of COMNET-IT

Origins

The origin of COMNET-IT stretches back to 1985 when a report, known as the *Menon Report*, was prepared at the request of the Commonwealth Heads of Government. This report identified methods for maximising the benefits of new technologies for developing countries. The main thrust of this report was in the study of the applications of information technologies in developing countries. Among its many findings, it stated that the range of applications of information technology in the Commonwealth countries were high, but their diffusion had been relatively limited. The reasons put forward in the report (Menon 1985, vol I) were:

The high cost of microelectronics is the main reason behind low adoption of the technology.

The scale of production is not large enough in the average developing country to sustain the high cost of purchasing and running the equipment.

Infrastructure requiring a pool of skilled personnel and appropriate training is required.

Sustainability of the production of electronic equipment in developing countries is restricted due to a number of market barriers. These include the lack of R&D capabilities, and more importantly, the lack of an international marketing and after-sales network.

Among its many recommendations, the Menon report advocated the creation of indigenous capacity in order to cope with the problem of adoption and development of technologies appropriate to local conditions. The importance of training, research and support was stressed and the efficient management of skills and financial resources was given high priority. The report suggested that Governments need to take on the responsibility of ensuring that the technology is delivered to the potential users and

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actively supported, with public sector institutions playing an increasingly active role. It was of the view that governments should take on the responsibility of developing a suitable climate for technological innovation and adopt a policy to purchase where possible technology produced indigenously. The Menon Report (1985, vol I) saw an important role for the Commonwealth through the Commonwealth Secretariat:

We do see an important role for the Commonwealth Secretariat in undertaking certain information and promotion activities and advisory services, as well as in organising training courses or seminars on the management of technological change.

These information and promotion activities were defined as follows (Menon 1985):

To encourage and, where requested, assist Commonwealth countries to organise the regular collection and dissemination of information, in an accessible form, on new technologies and their economic and social impact, drawing on countries' own experiences and in particular on the work of the UN and other international agencies.

To compile and distribute to member governments a quarterly newsletter aimed at policy makers, covering technical and socio-economic aspects of new technologies.

To undertake comparative studies of the impact in different environments of new technologies.

To raise the level of public knowledge of its activities in the technology field and their potential usefulness to member governments and non-governmental bodies; and

To promote greater discussion of the key technology policy issues at the

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meetings of Commonwealth Ministers and Officials.

The advisory services of the Commonwealth Secretariat were seen by the Menon Report to extend the focus and use of new technologies. The Report stated that training and exchange programmes could make a valuable contribution in improving knowledge of new technologies and their impact.

The Menon report was followed by extensive research within the Commonwealth examining national information technology policies and major applications for development (Commonwealth Secretariat 1988, 1990). The ensuing workshops and publications encouraged the development of informal networks for sharing experiences in information technology. At a pan-Commonwealth expert workshop held in London in November 1990 called "The Information Technology Policy Workshop", a number of country studies of the state of information technology were presented. The recommendations of the Menon Report were discussed at great length and strategies for implementing them were formulated. The establishment of a formal organisation as a mechanism for bringing about and maintaining increased collaboration was defined. Finally the workshop suggested the mission for this organisation and designated the name, The Commonwealth Network of Information Technology for Development, COMNET-IT.

The proceedings of the workshop indicate that the Commonwealth Secretariat felt that it was time to join other international agencies in pursuing information technology projects, and, in particular, networking. It was seen as an opportunity for the Commonwealth Secretariat to play a more active role for the Commonwealth. It was hoped that, by developing according to the guidelines laid out by the Menon Report, COMNET-IT would somehow be able to tackle the many issues raised. The notion that communication networks bring with them the promise of increased diffusion of skill and expertise, while training programmes could develop the ability to exploit the technology, played an important part in the formulation of COMNET-IT.

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Stated very generally, the participants of the 1990 workshop defined the objectives of COMNET-IT to be to facilitate the exchange of information on IT policies for national, economic and social development. The main ways in which information sharing was seen to take place within COMNET-IT included "access to and information about software applications, on data security and legislation, on national plans of Commonwealth countries and conferencing via the network". More specifically, the main areas in which the activities of COMNET-IT were envisioned to take place included: the provision of a regular newsletter, seminars, workshops and regular meetings, a physical communications network and CD-ROM publication of shared IT information.

The Commonwealth Secretariat was instructed to implement these activities at its own discretion and to seek possibilities for collaboration where appropriate. Its responsibilities were to (Commonwealth Secretariat 1990):

Announce and set up COMNET-IT.

Set up a Steering Committee with the mandate to define objectives, scope, membership and delivery mechanisms, assess the economic and administrative implications of establishing the network, and prepare an implementation plan.

Circulate the report of the Steering Committee to delegates and participants, countries, organisations and institutions that have been involved in the Commonwealth Secretariat's IT initiatives to date.

Provide dedicated resources at an appropriate level of influence to inaugurate and support the network and to service the Steering Committee.

Convene a Commonwealth-Wide meeting in a year's time to deliberate on the report of the Steering Committee.

In keeping with these responsibilities, COMNET-IT was established at a Working Group

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Meeting in 1990 which defined the broad objectives of COMNET-IT.

Evolution of the Network

When COMNET-IT was established in 1990, a number of institutions were requested by the Commonwealth Secretariat to take up COMNET-IT as networking initiative within their respective organisations. The idea was that these various people in different organisations would collaborate on task forces, and work together towards fulfilling the objectives laid out for COMNET-IT. The Commonwealth Secretariat realised that in order to make COMNET-IT workable, it would have to provide direction and assistance for COMNET-IT's activities. However, the machinery of the Commonwealth Secretariat was not geared towards administering an initiative such as COMNET-IT on a long-term basis. The Commonwealth Secretariat lacked the flexibility and administrative resources to run COMNET-IT according to the mandate set out by the Menon Report. In 1990, the Information Technology Policy Workshop had attempted to reduce the Commonwealth Secretariat's responsibility by giving the planning and administrative responsibilities of COMNET-IT to a specially appointed Steering Committee. But the funds remained with the Commonwealth Secretariat. It still had the responsibility of providing the resources for COMNET-IT and supporting the Steering Committee.

By 1992, it became apparent to those responsible for COMNET-IT at the Commonwealth Secretariat, that the success of COMNET-IT did not depend entirely upon achieving the ambitious goals laid down by the Menon Report, but through satisfying the need for networking people, institutions and groups of people and institutions in different parts of the world. In August a coordinator was employed to administer the project and in November 1992, COMNET-IT was distanced from the machinery of the Commonwealth Secretariat and became an independent association with its own charter and funds. This move was made in an effort to enable COMNET-IT to attract its own funds from donor agencies in addition to the Commonwealth Secretariat. As a result COMNET-IT became less constrained by the procedures of obtaining approval from within the Secretariat's bureaucracy and was free to carry out its activities.

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At the same time, in order to give COMNET-IT more direction, the Commonwealth Secretariat redefined the objectives of COMNET-IT. The intention was to enable COMNET-IT to utilise electronic networking technologies to bring about greater collaboration among groups of institutions (mostly in government). According to an official document drafted in November 1992, COMNET-IT came to be seen as a network of networks with two encompassing objectives (Constitution of COMNET-IT, 1992):

First, to identify cost-effective opportunities for enhancing human and technical cooperation within the Commonwealth by building networks of individuals and institutions which can be involved in the use of IT to accelerate socio-economic development. Capturing low cost electronic networking opportunities and promoting them within the context of specialist groups of people, it aims to provide existing organisations and specialist institutions with access to electronic networks and support for using them.

The second objective is more proactive. It is to initiate activities which will facilitate the sharing of experiences concerning successes and failures in IT applications, the impact of national policies, relevant research and training opportunities. To this end, the area of administrative reform has been identified as being most likely to benefit from networking. The need for key civil servants involved in administrative reform to communicate with each other to share experiences and ideas is one which the Commonwealth Secretariat is attempting to satisfy. To this end, a network of Management Development Institutions involved in administrative reform has been one of the main COMNET-IT initiatives. The main thrust of COMNET-IT's involvement in this area has been to foster the use and development of electronic networks and on-line access to databases. It is about sharing information, knowledge and skill in order to develop communities of experts.

The underlying principle behind the above objectives was to develop strategies for realistically assessing and enhancing the benefits of recent IT developments. It was about

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searching for opportunities in which existing infrastructures could be modified and enhanced without major costs, in order to facilitate the transfer of technical expertise and the diffusion and dissemination of appropriate knowledge. This was also the driving force behind the development of joint initiatives between and among other international organisations that could benefit from the exchange of information.

The shift in focus from the very grand and aspiring objectives laid out by the Menon Report to a more realistic, workable set of guidelines stated above, meant that COMNET-IT functioned as a set of task forces of coordinated activities and projects. COMNET-IT needed mechanisms for collaboration, alternative sources of funding and administrative resources beyond those available at the Commonwealth Secretariat. In particular, it needed an electronic communications infrastructure from which to develop and coordinate its proposed activities.

Structure in Task Forces

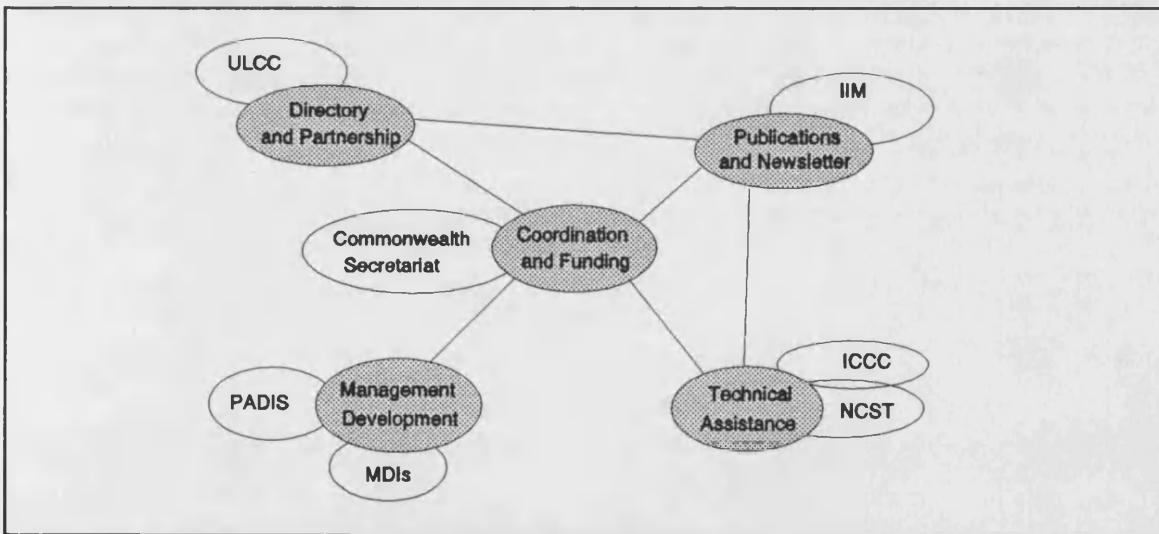


Figure 1: Initial Structure of COMNET-IT (1992-1994)

By the end of 1992, COMNET-IT had become established as a set of task forces administered and coordinated at the Commonwealth Secretariat in London. It had evolved a network structure which comprised a group of people who were responsible

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for setting its direction and for implementing plans of action. This group became known as COMNET-IT's steering group. Beyond this group, the structure of COMNET-IT was project based. Functioning as an umbrella organisation within which a series of related tasks were addressed, the structure was conceived as a network of task forces that had been given certain responsibilities and guidelines upon which to operate. The leaders of these task forces were also the members of the steering group which decided upon the future direction of COMNET-IT. Although there were certain financial incentives that motivated collaboration among members of the task forces and the Commonwealth Secretariat, membership was by invitation. The task forces were responsible for providing assistance and support for any of the projects that COMNET-IT became involved in. Often they proposed and spearheaded projects that fell into their area of expertise and interest. As illustrated in figure 1, The following task forces were active at the time on COMNET-IT projects:

Directory and Partnership

This task force was responsible for building upon and enhancing the value of existing professional networks by providing directories and by developing and supporting communities of interest. Based at the University of London Computer Centre (ULCC), this task force provided the COMNET-IT coordinating centre with access to the Internet and other network services. It had been involved in the development of a COMNET-IT section of the X500 Directory project that was also being undertaken at the ULCC.

Technical Assistance

This task force was set up to take responsibility for providing advice, and technical support to the other initiatives operating within COMNET-IT. Based at the National Institute of Science and Technology (NCST), in Bombay, India, it provided training programmes and user support on the 'how to join the network' starter pack. This task force had organised the COMNET-IT workshop which was hosted at the NCST from the 28th March to the 8th of April 1994.

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Publications and Newsletter

This task force was set up to take responsibility to facilitate the sharing of publications and other documents within the community of professionals involved in the area of Information Technology for Development. Based at the Indian Institute of Management (IIM) in Ahmedabad, India, this task force was involved in the publication of the joint IFIP/COMNET-IT newsletter, and support for other COMNET-IT publications. The task force also became involved in developing a network of research institutions.

Management Development

This task force was responsible for strengthening and developing lines of communication between Commonwealth national and regional Management Development Institutions (MDIs). Under the auspices of the Commonwealth Secretariat, this task force undertook to developing a regional initiative within Africa for electronically linking up MDIs involved in administrative reform programmes. In the period 1992-1994, this task force did not have an institutional base and was being administered at the Commonwealth Secretariat.

Role and Responsibilities of the Coordinator

The responsibilities of the coordinator involved the organisation of steering group meetings, and following them up with individual members. Responsibility for the general administration of the COMNET-IT Notice Board and managing further development was shared with the Directory and Partnership task force at the ULCC. The role of the coordinator was to administer and direct COMNET-IT projects which included costing out activities, negotiating services of the parties concerned (often in conjunction with steering group members) and formulating strategies for implementing projects such as GOVERNET. Occasionally, the coordinator was involved in formulating funding requests for COMNET-IT projects with a view to possibilities for collaboration with other international agencies. More peripheral responsibilities included writing articles for the IFIP WG9.4 Newsletter and various other periodicals, and responding to requests for information and general troubleshooting.

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Meeting and Working in Cyberspace

According to the constitution of COMNET-IT, meetings of the steering group members were to take place at least once a year. Initially known as general meetings, they were intended to govern the affairs of COMNET-IT and issue guidelines to the steering group for the general operation and management of their activities. The president and vice president of COMNET-IT were to be elected by the general meeting from amongst the task force leaders. The president was to chair the general meeting and if absent, the vice president was to chair the meeting. The general meeting was to ensure that the steering group was composed of task force leaders able and prepared to lead specialist groups to undertake activities on behalf of COMNET-IT. The task force leaders should decide upon the nature and membership of their task force and confirm this at each general meeting. Decisions of the steering group, which according to the constitution should be composed of the task force leaders, should be taken by consensus, but if needed a simple majority vote may be taken. Each member had one vote.

In practice, COMNET-IT's general meetings consisted of the steering group members, the Commonwealth Secretariat representative and the coordinator. The general meetings were referred to as simply steering group meetings which did not include a president and a vice-president but a chairperson elected from amongst the group members. However, in remaining consistent with the constitutional objectives of COMNET-IT, the steering group meetings were a mechanism by which strategic plans for COMNET-IT could be developed further and decisions taken. For example, the introduction of new members onto the steering group was a choice made by all the members. Additional responsibilities of the different members emerged from the meetings and were then followed up at successive meetings. The steering group came to be responsible for the implementation and operation of all COMNET-IT activities.

To be consistent with the general networking objectives of COMNET-IT, the steering group meetings took place electronically. An enhanced bulletin board with a talk facility allowing interactive sessions among multiple participants was used. All the members were required to log onto the COMNET-IT Notice Board at the same time from their

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respective countries/institutions wherever there was access to a public domain network, in particular, access to the Internet. The meetings were structured by an agenda which comprised constitutional items concerning membership and project items. The coordinator sent the steering group members this agenda by electronic mail and posted a copy on to the COMNET-IT Notice Board. In the meetings, the steering group members reported on progress and obtained feedback on the activities of their respective task forces. The chairperson made sure that all members had a chance to speak and air their views. Decisions were normally taken in a way that agreement on a particular course of action was sought before its implementation plan formulated.

Three group meetings took place between September 1993 and January 1994. These were attended by a total of five people: three task force leaders, the Commonwealth Secretariat representative who chaired the meetings and the COMNET-IT coordinator. The members of the steering group meetings who most often attended were: the Directory and Database Task Force leader who connected directly from the ULCC in London; the Technical Assistance Task Force leader who had to log on from the NCST in Bombay; the Publications and Newsletter Task Force leader who had to dial up to the host at the NCST in Bombay from the IIM at Ahmedabad in order to log onto the bulletin board. The Commonwealth Secretariat representative and the Coordinator both dialled onto the ULCC computer from the Commonwealth Secretariat to log onto the bulletin board.

Time differences were an issue in arranging the meetings; these problems caused delays initially but were easily overcome. However, a major challenge for the coordinator was to arrange the meetings at a time and date when all the steering group members would be able to attend simultaneously. Often synchronising busy agendas meant that meetings were delayed for many months. Even so, the technology enabled geographically distributed members to communicate interactively without having to travel long distances to be at the same place at the same time. The coordination effort alone could not be sufficient without the active participation, decision making and collaboration of the steering group members in a 'real time' meeting.

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COMNET-IT Activities and Projects

Within this structure of COMNET-IT, a range of activities and projects emerged. These projects and activities may be seen as an attempt by COMNET-IT to address the very broad recommendations of the Menon Report, while at the same time satisfying the more focused objectives defined in the subsequent workshops (in Commonwealth Secretariat 1990). As stated in more detail in Qureshi (1994a), these were:

The Newsletter

The COMNET-IT Newsletter, published in conjunction with IFIP WG 9.4 by the Publications and Newsletter Task Force at the IIM, was circulated to a broad community of academics, practitioners and international organisations. Although its focus was on IT policies in developing countries, its readers also included a large group in the so called developed countries.

A Network of Research Institutions

A related initiative, was the development of a Network of Research Institutions to bring together a core of professionals involved in Information Technology Policies in developing countries. This project was at the time in its formative stages and was being formulated by the Publication and Newsletter Task Force at IIM.

A Commonwealth Section in the X500 Directory

The development of a Commonwealth Section in the X500 directory project was being carried out by the Directory and Databases Task Force at the University of London Computer Centre (ULCC). This service was of use for people and organisations in a particular country who wanted to find out contact addresses. The X500 Directory of services, a global directory offering facilities to access others was offered by the ULCC's X500 Directory Services. At the time the services offered included a comprehensive telephone, postal and email directory which could be accessed using simple tools. This service was a public facility and could be used by anyone with access to the Internet. The Commonwealth section of the X500 directory enabled groups of professional and technical experts across the Commonwealth to be accessed. The X500 directory could

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be accessed through the COMNET-IT Notice Board. A contact person could be identified using simple queries, power searches, a browser, the yellow pages facility or simply by entering a search string.

The Starter Pack

A 'how to join the network' starter pack was developed by the Technical Assistance Task Force at the NCST in conjunction with the Management Development Task force in Africa. Considerable work had been undertaken concerning front-end software at the time. Several agencies, including United Nations Development Programme (UNDP) and the International Development Research Centre (IDRC) had examined a range of networking 'starter kits', appropriate for conditions in which the available hardware was limited, telephone communications costly, and power supplies unreliable. The COMNET-IT Technical Advice Task Force developed a starter pack, by picking up the experience of other agencies to be used within COMNET-IT's networking initiatives.

The Starter Pack came with a suite of software, a training manual called the *Computer Networking Primer* and a book called *The TCP/IP Companion*. The suite contained two software packages. The first was a FIDO based front end package initially developed by an IDRC funded project to encourage the development of PC based electronic networks in Africa. This enabled a PC, typically a 386 DOS based machine, to send and receive electronic mail messages by polling a local host (another PC) over a telephone line. On a FIDO network, a local host may be another PC acting as a gateway to an Internet machine. The second piece of software in the Starter Pack was called Waffle - a public domain software enabling a machine (typically a FIDONet host) to communicate with an Internet machine. Using this software, electronic mail circulating on FIDONet could easily be transferred on to the Internet and vice versa.

Emerging Networks

By the middle of 1994, negotiations were at hand between the Commonwealth Secretariat and the Maltese Government to give the Management Systems Unit (MSU) of the Maltese Government the responsibility of constituting COMNET-IT as a formal

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network organisation. The MSU was a well resourced information systems support and development unit responsible for providing IT support to the government agencies of Malta. The MSU would be responsible for coordinating the activities of COMNET-IT and providing support to the task forces. The *COMNET-IT Secretariat* at the MSU was to take on the role of the coordinator, foster linkages among the task forces and between the task forces and other organisations who stood to benefit from the use of electronic networking, access to a core of experts and joint funding arrangements. The MSU appointed full time staff and offered its administrative resources to run COMNET-IT. The transfer of COMNET-IT's coordinating centre to Malta was to mark a change in the image of COMNET-IT from a development oriented network to one with growing linkages in the Western world.

In the mean time, while COMNET-IT was being coordinated at the Commonwealth Secretariat, two projects had emerged. These networking initiatives merit further investigation as they were spawned by COMNET-IT while it was in the process of evolving a form of its own. They both involved the formation of networks of people who shared common concerns, were geographically dispersed and needed to exchange information and resources. These were the Informal Consultative Group of Information Technology for Development (ICGITD) and a Network of Administrative Reform known as, GOVERNET. The ICGITD was a network for donor collaboration supported by COMNET-IT and illustrates the way in which electronic networks may be used to support organisational and human networks among agencies based in western countries. The GOVERNET project was about linking up civil servants involved in administrative reform programmes in sub-saharan Africa. It illustrates networking among people and organisations in a developing world context.

The following sections explore the role of the ICGITD and GOVERNET projects further and describe how they function. The way in which both of these network initiatives have developed and the characteristics that they exhibit are highlighted. As both projects have emerged as networking initiatives supported by COMNET-IT, they may throw light on the nature of the networking activities developed by the project.

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Informal Consultative Group of Information Technology for Development (ICGITD)

The ICGITD was proposed at a collaborative meeting called "Information Technology for Development: Informal Consultation for Mobilising Resources" co-hosted by the Commonwealth Secretariat and the International Development Research Centre (IDRC) in London from the 26th to the 28th of January 1993. It comprised representatives from all the major and key agencies active in the field of IT for development. At the time, the ICGITD included the following international and donor agencies: the Canadian International Development Agency (CIDA), Commission of the European Communities (CEC DGXII), Danish International Development Agency (DANIDA), International Development Research Centre (IDRC), International Conference for Computer Communication (ICCC), United Nations University (UNU), United Nations Development Programme (UNDP), United Nations Educational, Social and Cultural Organisation (UNESCO), USAID Centre for Development, World Bank, and the African (ADB) and Caribbean Development (CDB) Banks. The ICGITD consisted of people representing a set of donor agencies who wanted to be able to exchange ideas and experiences on information technology projects in developing countries.

The purpose of this group was to enable and facilitate the interchange of project information. A mechanism was created to enable confidential discussions to take place between key professionals before projects were fully formulated and thereby to encourage new ideas to be floated among the key players of this group. The ultimate objective was to promote more effective collaboration in IT investments to support sustainable development. The Informal Consultative Group of Information Technology for Development (ICGITD) was administered by COMNET-IT but was not part of COMNET-IT. At the January 1993 meeting, COMNET-IT was given the mandate to provide the ICGITD, also known as the consultative group, with a set of specific services. COMNET-IT was to act as a *clearing house* by collecting newsletters from all the member institutions of the ICGITD and circulating a pack of these to all the members and the editors of the newsletters, and it was to allow members of the ICGITD use of its bulletin board and electronic meeting facilities for the purpose of their confidential discussions.

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Background

Collaboration in itself was not new. Donor agencies for international development of the US, Canada, Europe and Japan collaborated at the time on a CD-ROM database containing information of projects that they were carrying out. This enabled donor agencies to pool their resources into joint projects rather than bear the risk of funding duplicate projects in the same area and geographical regions. The development and marketing of the CD-ROM took place at the United Nations International Standards Organisation (ISO) Secretariat. Although the CD-ROM initiative was a valuable one, it was limited by high cost of procurement, maintenance and updating. Its availability was not only restricted by its high cost but also by the hardware necessary to use it. Although it was used within the major donor agencies its distribution was not intended to be limited to them, it was also targeted at the recipients of the funds. The CD-ROM database or a hard copy of it was made available to most public sector organisations of developing countries. The idea was to increase the awareness of organisations seeking funds as to the types of projects that were given high priority. Distributing the CD-ROM had not been entirely successful as the database printouts often made their way to the shelves in offices of high officials only to be made even more inaccessible to planners.

It was believed by those who had attempted to introduce the CD-ROM database, that information technology products would not be used by the high status officials who often stood to benefit most. This was attributed as the primary factor contributing to the limited application of CD-ROMs in the developing country context. The use of the CD-ROM itself required training which was often not readily available and cost more than most public sector organisations in developing countries could afford; additionally, the documentation was scant making it necessary to follow training courses in order to use the technology. Furthermore, the database itself required constant updating and dissemination to institutions using it; this was a slow process that compromised the validity of the information contained on the CD-ROM database. In effect, the CD-ROM initiative was limited in its scope and had not satisfied donor agencies in their need for exchanging information on projects in the pipeline. There was also a need for donor organisations to communicate on an informal and confidential basis. The Informal

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Consultative Group of Information Technology for Development (ICGITD) was formulated in order to fulfil this need.

The Mechanism

A mechanism for consultation and collaboration was agreed upon to guide the members of the ICGITD and to provide a means of communicating on a regular basis with respect to their initiatives in the developing world. The primary objectives of this mechanism as proposed at the collaborative meeting in January 1993, were (Balson and Manning 1993):

Methods and criteria for identifying appropriate officials within key agencies.

Electronic mechanisms for rapid sharing of proposals and developments.

Suggestions regarding procedural mechanisms for sharing information without implications of formal agency commitment - through the Journal of IT for Development.

An electronic mechanism for meeting and consultation was agreed upon in which the members of this group were able to communicate electronically. The intention was that COMNET-IT would be involved in (Balson and Manning 1993):

Facilitating the operation of the software and enabling the registration of ICGITD members.

Providing training support and documentation for those using this facility.

Moderating the discussions to ensure that members are able to share their views and at the same time allow other members to do so. Ideas and views generated by these sessions will then be compiled and distributed to those involved.

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In response to the above, COMNET-IT set out to fulfil its role as a *clearing house* for the newsletters produced by the member organisations relating to IT for development (not restricted to the Commonwealth), ensuring that all editors and members of ICGITD received copies of the full range of newsletters. At the time, some discussions were in hand about distributing edited highlights from the global array of IT for development newsletters for press distribution to encourage public IT awareness. The COMNET-IT bulletin board service was made available to all the ICGITD members and was used to encourage confidential electronic discussion. In order to do so, the COMNET-IT Notice Board was enhanced to accommodate the needs of the ICGITD members. The result of this development work was an asynchronous capability for structuring discussions, and a synchronous talk facility allowing electronic meetings to take place at the same time among people situated in different parts of the world. Technical considerations such as confidentiality and privacy meant that other COMNET-IT users were not given access to information generated by ICGITD users.

Structuring Discussions

In this section a few parts of the ICGITD Discussion Board will be used to illustrate how the asynchronous electronic mechanism operated. The generation and evaluation of ideas took place on a discussion board facility on the COMNET-IT Notice Board which

```
|V|          ICGITD Discussion Board <D>          |V|
|-----|
Add      [I] - Impacts
Menu    [P] = IT Policy
Menu    [R] = Projects
Menu    [G] = Regional Issues

Select, or [RET]:Back [SPACE] [/]:Find [E]:Edit Menu [?]:Help.
```

1. The ICGITD Discussion Board

enabled topics of discussion to be organised in the form of menu items or files. These asynchronous discussions had to be moderated and users had to make a choice early on in the presentation of their points on how to structure their ideas on the discussion board. The first level of the ICGITD discussions as illustrated in screen 1, were composed of four main topics: one was a file and three were menu items. The first topic called *Impacts* was entered as a file (there is an *Add* written next to it) and could be accessed by pressing **I** on the keyboard. A portion of the discussion file containing

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comments from different participants is illustrated in screen 2.

In this file, participants added comments for discussion or responded to existing comments on the file by either sending private messages to the author of a comment or by adding additional comments to this file. The *Impacts* file provided the capability for idea generation on a particular topic. Although a certain amount of

brainstorming may have occurred in the file, it was not possible to evaluate the topic as the nature of the discussion on a file was more fluid and less structured than a discussion that may have been taking place under menu items.

An illustration of the way in which structured discussions took place using menu items is provided by the topic, *IT Policy*; this was a menu item comprising two topics created as files. As illustrated in screen 3, the two topics being discussed at the time were: *IT Policy in Africa*, and

Is there is a need ? In this way a particular topic could be broken down to into separate menu items of discussion files. There were no voting tools available on the discussion board. The discussion board was more suitable for exchanging information and ideas for consultation rather than for decision making. However, the discussion board did enable certain areas for collaboration to be identified.

```
- Is the effect of the existing It policy manifest in the organisation's IT
planning strategies? If so, to what extent is the stipulated change
measurable?
-----[Thu Nov 17 11:25:03 1994]-----
From: Okot-Uma Rogers (rogers)
Subject: Impacts/Country Aspects of IT Policy

The following aspects of IT policy in developing countries may be worth
considering:
- Operational problems
- Problems of Context
- Strategy Problems

[Q]/[RET]:Exit [S]:Send Reply [A]:Add [E]:Edit [?]:Help (100%)
```

2. The ICGITD Discussion Board: A Portion of the Impacts File

```
|V|                IT Policy <DP>                |V|
|-----|-----|-----|-----|-----|-----|
                [I] - IT Policy in Africa
                [T] - Is there a need ?

Select, or [RET]:Back [SPACE] [/]:Find [E]:Edit Menu [?]:Help.
```

3. The ICGITD Discussion Board: IT Policy

Conducting Meetings

*Chairman 'I would be grateful for your suggestions on the first item:
'Use of It and network applications.'*

I 'To me Use of IT is too broad what you really mean by it?'

L 'Can we define what we mean by use, e.g. development communications'

Chairman 'Let us look at network applications in development to begin with'

R 'I think use here would mean application of It in a particular context. One way to start is to select a context.'

I 'networking would be a case of application'

R 'Such as, say, civil service reform'

Chairman '1. use of networking in training 2. developing a database on special topics such as administrative and managerial reform and providing access to interested users and extending it through use.'

I 'I would very much support 2. in Chairman's proposal'

R 'Good suggestion.'

Transcript 1: Achieving focus

Conducting group meetings on the synchronous talker required a different mode of interaction than the discussion board. Electronic meetings were held using a talk facility on the COMNET-IT Notice Board which could support up to 450 people at any one time, but a productive meeting had between 5 and 7 people. The talker facilitated brainstorming on specific issues and enabled focus to be achieved on specific areas requiring decisions to be made or further discussion. This form of synchronous computer conferencing was seen to be useful as long as there were some clearly defined objectives. As stated by a participant of an electronic ICGITD meeting: "Our experience with computer conferencing is that the more clearly defined the objectives of the exercise and the topic problem being discussed, the more likely something concrete can come out of it." The synchronous talker was useful in enabling greater focus on the more general topics posted on the discussion board. As illustrated in transcript 1 of an ICGITD meeting, the synchronous discussion began on a very broad topic and focused on a particular practical, workable aspect of the topic. At the same time, some differences of

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opinion did emerge while ideas were being generated. This is illustrated in transcript 2 of an electronic ICGITD meeting.

L 'We have found in our INDIX meetings with other donor organizations at the bilateral level that government policy still severely limits information sharing and access between countries'

R 'I am sure governments are able to isolate information that can be put into the public domain as opposed to sensitive information. Transparency in the age of open governance should facilitate this.'

Transcript 2: Diverse opinions

The above suggests that while the COMNET-IT Notice Board facilitated and enabled a mechanism for consultation and collaboration, it could also be seen as a means of exposing the views of people of the different institutions to each other. This mechanism for consultation and collaboration reflected a politically sensitive form of communication among a group of donor agencies who had until recently been unaccustomed to this use of the technology.

The GOVERNET Project

In remaining consistent with its mandate as it was outlined in the "Information Technology Policies" workshop in London in November 1990, COMNET-IT developed a network in the area of administrative reform. The role of COMNET-IT was to extend the potential of the network technology to a new group of users who had until recently been unaware of the potential of this form of communication. The intention was to provide email and conferencing services between key Management Development Institutions and, ultimately, between key agencies of government, where there was a leading responsibility for management improvement in government.

The GOVERNET project was the largest of all COMNET-IT initiatives. It started with the development of a network of Management Development Institutions (MDIs) in eastern and southern Africa, gradually progressing into west Africa as demand for membership by institutions involved in administrative reform increased. Although, in principal GOVERNET was at the time (1993), spearheaded by COMNET-IT's

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coordinating centre at the Commonwealth Secretariat, (which had taken responsibility for the Management Development Task Force) its implementation depended upon the combined initiative and efforts of a wider group of people. The electronic networking concerns of the project were initially the responsibility of a freelance consultant well known for his hands-on implementation work for a number of development agencies and the administration was the responsibility of COMNET-IT's coordinator. Although, funding and direction for GOVERNET was initially taken care of by the Commonwealth Secretariat, further development of the network and its administration was to be handed over to a more appropriate local institution. This institutional networking among the MDIs was to the Association of Management Training Institutes of Eastern and Southern Africa (AMTIESA).

It was believed by the Commonwealth Secretariat that coordinating the activities of interdependent institutions was a necessary factor in bringing about effective government in Africa. The view that administrative reform in public administrations was necessary in order to achieve a more healthy political and economic future for Africa prevailed. The position taken by the Commonwealth Secretariat was that key officials involved in administrative reform should be able to exchange experiences, opinions and ideas with their counterparts and associates in other countries. Networks in which opinion formers could discuss their views with others involved in administrative reform should bring about better government.

In its work with governments of the Commonwealth, the Secretariat observed that the pace of administrative and managerial reform within governments was quickening in response to the increasing pressure on governments to scale down the scope and size of the public sector, while strengthening the core structures of government. It was believed by those at the Commonwealth Secretariat that experience in the design of core elements of reform programmes and in applying the techniques and approaches for implementing sustainable programmes was growing. Despite this increasing body of knowledge, many senior officials found it difficult to gain access to useable information to support the design and implementation of their reform programmes. The Secretariat's experience

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within Africa suggested that many countries were seeking information urgently on aspects of public sector reform which other countries of the region had pursued, or assessed and rejected. In addition, the limited strategic planning capacity within many governments restricted the ability of senior officials to explore the full range of policy options available (Commonwealth Secretariat 1991). There was a sense among those who explored these issues, that a part of the route out of this dilemma was through better communications and fostering the exchange of information at all levels in civil society. As Sandbrook (1993, p.146) stated:

A dense web of independent associations changes the political equation by easing the apathy and acquiescence on which authoritarian regimes thrive. Networking on a national, regional and global scale among civil associations sharing common objectives is a potent means of building the social power of civil society. Networking allows organisations to share information, build solidarity on issues, promote joint or simultaneous action, and bring external publicity to bear on abuses of power or wrong-headed government policies in any member country.... networks have the advantage of resiliency - the cooptation of one or more members does not destroy the network.

There appeared to be a glimmer of hope in networking among civil associations sharing common objectives. In as much as networking may have been an answer to the apathy and acquiescence of the authoritarian regimes in Africa, it also brought with it the promise of additional funding from donor agencies⁴. The provision of an electronic network to the key officials responsible for developing or implementing such programmes could facilitate professional collaboration, and even provide access to state of the art

⁴ The Structural Adjustment policies initiated by the World Bank in the 1980s failed to work for a number of reasons not the least of which have to do with the structural inefficiencies of the public sector bureaucracies. Economic hardships that have plagued many western economies to date had made it impossible to continue to provide high levels of aid to developing countries. The main advantage of funding networking projects was that they could be implemented on a collaborative basis and became self-sustaining as soon as a user base becomes established. It made possible joint-funding arrangements between a number of donor agencies and often involved many recipient institutions.

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databases concerning regional and broader developments in administrative reform.

In view of this, the Commonwealth Secretariat wanted public sector officials to take part in communicating through electronic networks. Accessing information through colleagues in other parts of the world and exchanging views and ideas regarding administration was at the time a primary concern of the Commonwealth Secretariat. The need to communicate with appropriate, motivated officials in Africa was seen to be imperative for the proper functioning of its programmes (ie reform and training). In addition, the Secretariat needed to revamp its own image in the Commonwealth, to be seen as a working, productive organisation and not just a bureaucracy. Furthermore it was hoped that the dialogue and debate generated in the Commonwealth Secretariat's workshops and training programmes would continue as a result of computer conferencing enabled by electronic network technology.

Implementing GOVERNET in Stages

Against this background, the Commonwealth Secretariat formulated GOVERNET to serve as a regional project within COMNET-IT. This was carried out in collaboration with other organisations involved in the use and development of electronic communication networks within southern and eastern Africa. The objective of GOVERNET was to utilise and add value to the existing electronic networks operating within these Commonwealth countries in Africa. The plan of action for GOVERNET illustrates the above perspective. In achieving its core objective, GOVERNET was to develop lines of professional collaboration and provide access to information concerning administrative and managerial reforms. The guidelines with which it was to function (GOVERNET, draft 1 confidential working document March 1993), involved:

The introduction of electronic messaging between members of a tightly defined group of officials and experts.

The development of electronic mail directories grouped by interest and expertise.

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The provision of file transfer facilities allowing rapid sharing of draft policy proposals and discussion documents.

The provision of access to moderated bulletin boards serving as clearing houses for information requests and for the posting of notices concerning work in progress.

The provision of access to databases offering practical information concerning good practice in specific reform areas.

Realising that many of the objectives initially set out for GOVERNET may not be very realistic due to the nature of the communications infrastructure (or lack of) in Africa, the need for a study of the initial status of networks in Africa had to be undertaken. In view of this, a staged approach for implementing GOVERNET was put forward involving a series of steps. These were:

1. *Research*
2. *Identification of linkages*
3. *Identification of key institutions*
4. *Development and strengthening of connections*
5. *Installation and training*
6. *Maintenance and support*

The implementation plan for GOVERNET assumed a need for electronic networking among civil servants involved in administrative reform programmes. However, it must not be forgotten that the main thrust of GOVERNET was not to satisfy a particular need or to solve a problem but to "utilise and add value to the existing electronic networks in Africa" (GOVERNET Project Document, 1993). The intention was that by providing access to electronic communication technology to a group of people who had not previously been exposed to it (civil servants involved in administrative reform programmes), GOVERNET would be able to serve as a catalyst to bring about greater

communication and collaboration.

Research into electronic networks in Africa

Given the disparate growth of electronic networks in Africa, there was at the time of writing this dissertation, no comprehensive technical overview of the operational capacity of the existing electronic networks. However, there was at the time, considerable activity to advance the development of electronic networks, particularly in, the eastern and southern regions of Africa. There were a number of electronic communication networks in various stages of development, operating largely for a particular community of professionals, most of which belonged to the IT community. The available networks were primarily small and not very well connected, operating largely on a regional basis. The connectivity between the various regional networks was very difficult to ascertain as many had developed autonomously. It was thus necessary to establish an understanding of the state of electronic networks in Africa.

International agencies, particularly those funding large networking projects, felt that there was a need to tap the resources of Africa and to develop a means of communication that could survive disruption caused by a constant stream of political and economic unrest. Low cost electronic networking in Africa had been remarkably successful with the rapid development of FIDO technology and Association for Progressive Communications (APC) networks. The number of nodes operating in Africa had more than doubled over two years (Jensen 1993). The rise of the APC networks operating on a strictly non-governmental basis had been significant in stimulating the rise in low cost electronic networking. Most APC networks operated gateways on PCs and modems connected to telephone lines. The purpose of these networks was to allow communication among people active in environment, human rights, development and peace initiatives. In 1993, there were 16,000 users in 94 countries of the world on APC networks⁵. These networks

⁵ Supporting these users were a range of small networks or members of the APC which included Greenet based in London, the UK; Alternex based in Rio de Janeiro, Brazil; Chasque based in Montevideo, Uruguay; Comlink based in Hanover, Germany; Ecu nex based in Quito, Ecuador; GlasNet based in Moscow, Russia; the Institute for Global Communications San Francisco, USA; Nicarao based in Managua, Nicaragua; NordNet, based in Sweden; Pegasus, Australia; and Web, operated from Toronto in Canada (Greenet

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were built upon a mixture of FIDO and Unix (packet switching) technology to link up to the academic networks such as Internet and Bitnet.

Much of the electronic communication infrastructure in Africa was based upon FIDO technology, a low cost microcomputer based network that could be used over poor telephone lines and may support up to 100 users on a single phone line. It did not allow interactive real time messaging but was an effective electronic mailing system. Originally run for MS-DOS based hosts, FIDO software could at the time run under various environments including Macintosh, Amiga, Atari, CP/M, MVS and Tandy machines; it could also be upgraded to Unix. FIDONet began in 1984 with 100 nodes and had grown to over 20,000 nodes in 1993; these nodes moved email and enews over the public telephone network using a unique protocol and data format designed to keep telephone time at a minimum (Bush 1993). It has been estimated that FIDONet software could reduce the length of a phone call by 80-95 percent over the time taken for a standard interactive, manually controlled host session with a remote host. Messages could be prepared prior to transmission on any word processor and then transmitted using a standard 2400 baud modem linking a PC to a telephone line. The FIDO file transfer protocols were highly resilient to line noise and satellite delays and were able to adjust packet size accordingly. If a connection broke while a file was being transferred, the software could pick up where it left off on the next call. This was particularly important when transporting large binary files where the possibility of losing the connection over poor quality lines was significant (PADIS 1993).

Using FIDO software, a DOS based personal computer could be used as a host to direct electronic mail traffic over telephone wires. FIDO technology and APC networks formed the basis of a number of networking projects operating in Africa at the time. In a study published in April 1992, a total of 16 different networking projects were reported to be operating in Africa (Rinaf 1992). These networking activities ranged from the implementation of store and forward (FIDO) links to local FIDONet hosts or the

1993).

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development of local FIDONet hosts, to simply forming expert groups with little or no emphasis on electronic networking. These are explored further in Appendix I.

A notable example of such a networking initiative was the NGONET Africa project based at the Environmental Liaison Centre International (ELCI) in Nairobi. Using a high-speed modem to make daily calls to the GreenNet FIDO gateway in London, this project supported the MANGO (Microcomputer Assistance for NGO's) FIDO bulletin board project in Zimbabwe and assisted the establishment of a further bulletin board system in Dakar and in Tunis. The Eastern and Southern African Network (ESANET), a pilot project based at the Nairobi Institute of Computer Science, was set up to link researchers at the universities of Uganda, Tanzania, Zambia, Zimbabwe and Kenya with each other and with researchers worldwide by installing electronic mail facilities at the computer centres of the universities of these countries. A more controversial project, the HealthNet project, was the first initiative in Africa to use satellite links, established at a time when it was very difficult to obtain government permission to install a satellite ground station. African governments were threatened by the loss of control over their communications infrastructure. HealthNet's traffic was initially limited to health related issues and it was up to the individual participating institutions to obtain clearance from the authorities for a wider interpretation of what they considered to be a health related issue. At the time, only Kenya, Uganda, Mozambique, and Zambia had obtained approval to use HealthNet.

With the support of international aid and United Nations agencies, the development of low cost personal computer based hosts had proliferated. The volume of traffic was particularly high considering the international direct dial costs involved. The development of electronic networks in Africa has been driven by technological pressures and possibilities, while being restrained by regional administrative and political realities. The principal users of electronic networks are those responsible for their development and although this technology was dominated by a group of technical experts, pressure from users and potential users was emerging but was not of a very large scale. More significantly, such pressure to shape electronic networks to the needs of non-technical

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people was unlikely to develop in a situation where such potential users had no means of assessing the relevance of the technology to their own work and profession.

The FIDO based electronic networks were dependent upon an ailing telecommunications infrastructure impaired by overuse and lack of maintenance. However, this is not to say that the use of electronic mail was similarly restrained. Electronic mail communication was apparent in the way in which electronic mail messages made their way out of Africa through numerous gateways all over the world, before they finally reached their respective destinations. The journey of the emails revealed the existence of various carriers reflecting the plethora of electronic networks that operated in Africa as projects funded by combinations of international and funding agencies (see Appendix I). Unscrambling the nature and function of these was useful when attempting to add yet another network to the existing web of electronic and aspiring networks in Africa. Possibilities for collaboration with existing electronic networks became apparent as they could potentially ease COMNET-IT's task in implementing GOVERNET and at the same time avoid unnecessary duplication of scarce resources (Qureshi 1994b).

Identification of linkages

Following research into electronic networking in Africa, the second stage was to find out the extent to which these networks were connected and identify ways in which they may be used. Interfacing problems were very likely in a situation where a number of different networks operated. The issue was first, to discover the extent of connectivity among the different electronic networks and second, to find out whether it was possible to link up to them at reasonable cost. A series of possibilities and related issues arose when considering the connectivity among and to electronic networks. In particular, considerations of what type of hosts were available, how they could be accessed, how much were they used, what was their capacity and to what extent were they reliable? The security and integrity of these network hosts had to be considered as well. It was apparent that the GOVERNET project needed to utilise existing communication networks and rely primarily upon a store and forward technology that was restricted to asynchronous communication such as email.

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Table 1: Activity and Message Traffic

Source: Mike Jensen (27th August 1992 to 12th October 1992)

	MANGO Harare	ELCI Nairobi	ENDA-DAKAR Tunis
No Users set up	68	38	16
No of Regular Users	15	20	4
No of messages sent/day	28	7	2
No of messages/day/user (sent&received)	4	1	1
%age messages received (incoming/total)	53	43	43
%age messages sent (outgoing/total)	47	57	57
Message size in Kilobytes	1.3	1	0.8
%age local messages	48	59	53
%age external messages	52	41	47
IDD Speed in KB/Min	17	16	15
No of IDD calls per day	2	1	1
IDD length in minutes	3	1	3
Incoming calls per day	25	11	1
Outgoing calls per day	2	0	1
Capacity (Online minutes per day)	31	8	5
Ability to cope with additional traffic ⁶	90	30	7
Message traffic (Kilobytes/day)	70	18	4
Total traffic (Kilobytes/day)	280	71	54
No. of conferences	22	6	31
International gateway	Worknet	GreenNet	GreenNet

Table 1, illustrates that there were at the time two international gateways in eastern and southern Africa through which electronic mail traffic was routed; these were in London (GreenNet) and Johannesburg (WorkNet). It also illustrated that the volume of email traffic in eastern and southern Africa (MANGO, ELCI) was greater than that in north

⁶ This is calculated by the following formula: daily online time + (total daily calls x post-call message processing time)

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west Africa (ENDA-DAKAR). There was a large user base in eastern and southern Africa which gave an indication of the extent to which electronic networking initiatives could be potentially self-sustaining. It is interesting to note in the data illustrated in table 1, that the capacity of MANGO and ELCI was directly proportional to message traffic. In effect, the hosts were able to cope with rising demand by increasing their capacity.

Unlike the above networks, GOVERNET was not concerned with becoming a network host, but was more concerned with utilising the existing hosts and the software that they offered. This meant that MDIs were given modems with which they could dial up to their nearest FIDO hosts. GOVERNET was also dependent upon existing electronic network providers such as ESANET, ELCI, MANGO, and WORKNET. While MANGO and WORKNET had reliable system operators and good working equipment, the MDIs on GOVERNET would be well supported. However, for MDIs that had to use nodes such as ELCI or ESANET (both in Nairobi), issues arose as to who was ultimately responsible for training and support of the users. GOVERNET was not alone in this dependency, PADISNET (of the PADIS project), and GHASTINET (in Ghana) were also dependent on local system operators. This dependency however, had not significantly hindered use as is illustrated in table 2.

Table 2: Users and Main Hosts

Source: Transcripts from local gateways, Mark Bennet.

ELCI (Oct 2/92)

MANGO (Oct 2/92)

City	No of Users	City	No of Users
Nairobi	51	Harare	51
Arusha	2	Outside Harare	8
Mombasa	2	Bulawayo	2
Machakos	1	Mozambique	1
Kisumu	2	Maputo	1
Kilifi	1	Midlands	1
Voi	1	Malawi	1
Embu	1	Mashonaland	1
Maseno	2	Roving	1
Total	63	Total	67

African Standards Office (Dec 1/92)

City	No of Users
Nairobi	7
Arusha	1
Total	8

It is apparent in table 2, that although a majority of the users were connected from the main cities, almost 24% of the users connected from rural outposts. For a particular node in Nairobi, the African Standards Office ran its own FIDO network host instead of using the services of ELCI also in Nairobi. This competition from another node in the same city may explain why the volume of ELCI's traffic was considerably lower than that of MANGO's.

Identification of key institutions

The third stage involved the identification of key public sector Management Development Institutions (MDIs) to be included in GOVERNMENT. These institutions had come into existence as a means of training public servants in good practice of

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administrative reform. They have had historic links with the Commonwealth Secretariat in terms of the funding and development of training programmes. The primary focus of GOVERNET was to bring together a group of MDIs in the Commonwealth countries of eastern and southern Africa. Typically these institutions were heavily involved in developing training programmes and providing training in areas ranging from management practice to computer skills. Although these institutions operated independently of each other, the Commonwealth Secretariat was of the opinion that these institutions needed to communicate more frequently amongst themselves. This opinion was supported by the Secretary General of AMTIESA in Nairobi who was championing the cause of networking in Africa. The remaining MDIs that were to be linked up through GOVERNET were: KIA, KIM and APAM in Kenya, ESAMI in Tanzania, IPA in Uganda, MIM in Malawi, IDM in Botswana, LIPA in Lesotho, SIM in Seychelles, SIMPA in Swaziland, NIPA in Zambia and ZIPAM in Zimbabwe. The initial structure proposed for GOVERNET is illustrated in figure 2.

The capacity of these institutions to use electronic mail and benefit from it was contingent upon a number of factors: if the technology was seen as being imposed upon

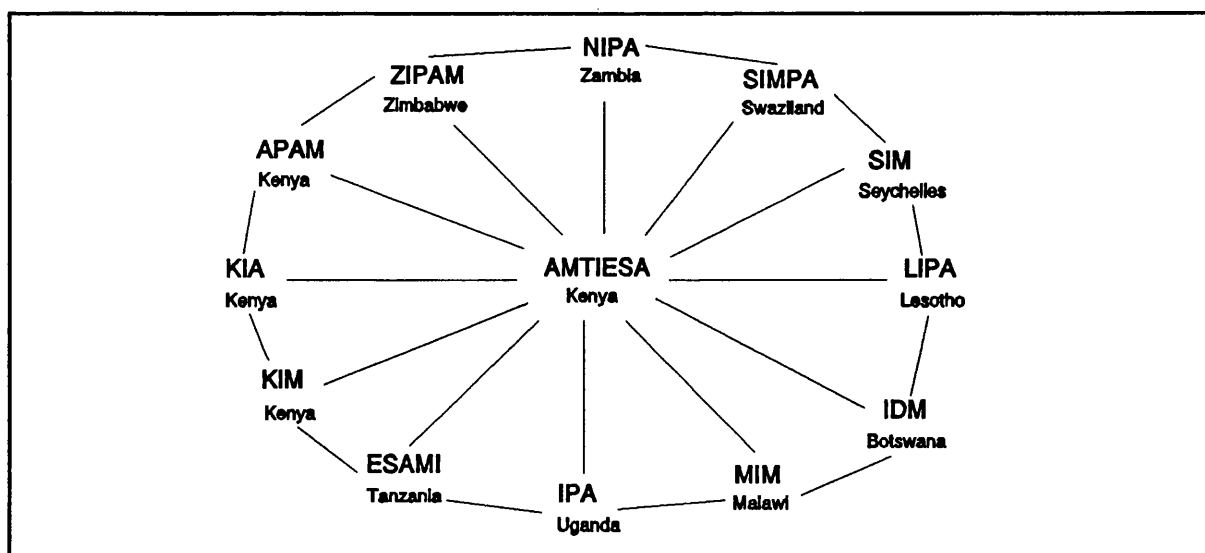


Figure 2: Initial Structure of GOVERNET (1992-1994)

the institutions its use would have been prejudiced from the outset; if, on the other hand,

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the technology was seen as a motivating factor for certain experts to communicate with like minded experts in other parts of Africa and the world, then this form of communication may have been taken up with added impetus. This simple reasoning formed the basis for selecting institutions which were to be at the core of GOVERNET. However, the task of ensuring that there was an environment within the institutions that was conducive to the use of electronic communications was not simple. In addition to factors that brought about resistance to the use of information technology in general, were those that limited the use of electronic communications. Such use had to be demand led in order to be successful. Often it was the initiative of a single person in an institution that pushed the use and development of electronic communications. And yet, there was concern that the institution may have been in danger of having yet another obsolete piece of equipment if the individual in question decided to leave.

Developing and strengthening of connections

The fourth stage involved developing, strengthening and supplementing existing electronic networks. This stage built upon the available low cost networks using locally developed public domain software to encourage the use of local networks, and then linked the local networks to the Internet through leased lines and/or FIDO links. It was hoped that existing low-cost electronic network links could be enhanced with user friendly front-end software developed locally and in conjunction with COMNET-IT's Technical Assistance task force. The software was then piloted in training programmes and at certain specified sites.

Linking the local networks to the Internet further on in the implementation process, provided a means of ensuring connectivity with the major academic networks and direct electronic communication with the rest of the world. Installing a leased line required technical expertise to be available locally. At the time, there was only one leased line in sub-Saharan Africa; it connected the Rhodes University in Johannesburg to an institution in the USA. At the same time, other countries in eastern and southern Africa were in the process of developing direct connections to this Internet host in South Africa. For an overview of network connectivity in Africa, please refer to table 1, in Appendix I.

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Installation and training

The fifth stage concerned linking the MDIs electronically and installing equipment (PCs and modems) within the institutions and providing training to develop skills in the use of the electronic mailing system. The sustainability of a network connection, in particular of the leased line, required a certain number of users. The training of users alone was not sufficient to ensure that the nodes would continue to be utilised, they had to be supported on an ongoing basis. It was important that the requisite technical ability was present and that there was a mechanism for maintaining and upgrading the network hosts. Email messages had been known to be stuck at hosts for weeks before a system operator got around to servicing the host. This was because in addition to being system operators, the people with the technical skills were also employed elsewhere in order to maintain a reasonable income.

Maintenance and support

The sixth stage involved the development of local expertise for the maintenance and support of the electronic communications links. The network required the support of institutions that were capable of housing the electronic media as well as a core of experts who were able to provide immediate and ongoing support to an increasing body of varied users. This task lent itself to a collaborative arrangement with other network hosts. The long term scope of the GOVERNET project went beyond implementing electronic linkages. Following the setting up of electronic linkages between the MDIs involved in training programmes in administrative reform, the project was to expand to include policy making units within government. Key officials within government were to be linked up electronically on a strictly confidential basis allowing them to communicate on matters regarding administrative reform. The implementation of this part of GOVERNET was seen as requiring extensive professional collaboration and a programme of in-country regional seminars. While the initial scope of GOVERNET was to provide access to existing databases, negotiations were being undertaken for the development of a specialised administrative reform database.

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The Process

The actual process of implementing the plan for GOVERNET was not so clear and straightforward especially as the funds to carry out such an exercise were sporadic⁷ and because the existing electronic communication infrastructure in Africa had to be built upon. Given the numerous networks already functioning in Africa, as illustrated in Appendix I, the scope for collaboration was extensive. In the initial stages of the conception of GOVERNET possibilities for collaborating with the other networks was sought. It was hoped that by using the electronic networks already in place and the training services claimed by some of the existing networks in Africa, COMNET-IT could execute GOVERNET by simply bringing together the existing mass of networks for the purpose of involving certain key public sector officials. Through the Secretariat's links with IDRC, collaboration with the Pan African Development Information System (PADIS) based in Addis Ababa, Ethiopia was thought most appropriate at the time.

The Pan African Development Information System (PADIS)

At the time, PADIS was in the process of building a network to link its database to users all over Africa and to other databases within Africa. A very ambitious project that was funded by the IDRC under the auspices of the United Nations Economic Commission for Africa, this was the closest thing to the development of an infrastructure for electronic networking in Africa. The networking of PADIS had been running for twelve years and had an impressive flow of documents advertising its activities. Funded on a three year basis, PADIS had a high profile and an institutional base with the ability to administer extended amounts of resources. PADIS utilised low-cost technology to support a broad base of users and appeared to have a good understanding of the electronic

⁷ During the time when GOVERNET was being formulated, the Commonwealth Secretariat (in June 1993) was going through a massive restructuring process in which entire departments found their staff and funds stripped to a minimum. Among the most severe casualties were departments that found their staff reduced from forty five to only five people. The Management Development Programme, which is the guardian of COMNET-IT, demonstrated an area of promise and growth for the Secretariat and retained a majority of its staff. The Management Development Programme and the Fellowships and Training Programme were merged into one: the Management Training Services Department. Being an independent association and having the support of a more steady department of the Commonwealth Secretariat, COMNET-IT continued to function in its usual manner.

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networking projects operating in Africa and of the telecommunications problems in Africa. The PADIS project focused on the need for a technology able to survive on a few telephone lines, inadequate bandwidth, slow network growth, antiquated switching systems, high pricing of private telephone facilities and a wide variation in national network infrastructures. It was estimated that in 1992, there was one telephone per one thousand inhabitants and the vast rural areas which were the home of 80 percent of the population often have no access to the most basic telecommunications facilities (PADIS 1992). Additional difficulties in Africa identified by PADIS (PADIS 1992) were:

Poor switching equipment which results in incompatible signalling systems between countries.

Unreliable primary power sources which cause traffic disruptions.

According to the PADIS project document problems of maintaining the technology was the result of:

Lack of trained manpower to support the network technologies.

Inappropriate management information systems for monitoring operational status of the networks.

Inadequate budget provisions to cover maintenance requirements, and

continuous deterioration of lines due to climatic conditions for which the equipment is not calibrated.

The PADIS project document proposed that in spite of such obstacles, the store and forward FIDO technology which used dial-up connections (explained earlier) was the most appropriate. This technology had been tried and tested in a number of settings and had been developed further indigenously to suit local conditions. Based on this

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technology, PADIS proposed to build sustainable networks in twenty four countries from four sub-regions; these were: East Africa, Southern Africa, West Africa and Central Africa. It intended to do so by developing a critical mass of users from national institutions, NGOs, academic institutions, the private sector and international organisations. The idea was that users of the networks would also be responsible for financing its operation and expansion. Among its many plans, the one of most interest for the purpose of GOVERNET, was for PADIS to develop a cadre of at least nine (three at national, three at sub-regional and three at regional levels) indigenous trainers and troubleshooters to provide technical support to users and to support sub-regional, regional and international networks. In addition, there were to be at least three network installers who were to provide technical support to other users at each institutional level; and at least thirty installers in each country to provide immediate network advice and technical support (PADIS 1992).

In principle, if the plan set out by PADIS was to be implemented then GOVERNET could provide a critical mass of users that rely on the training services of PADIS at national, sub-regional and regional levels. GOVERNET would concentrate on building a user group within the MDIs in the ten countries identified and linking them up to local FIDONet hosts. On this basis, COMNET-IT agreed in principle to collaborate with PADIS towards the development of GOVERNET. According to a verbal agreement between the IDRC (the agency funding PADIS) and the Commonwealth Secretariat, the fourth, fifth and sixth stages involving technical training, support and maintenance for GOVERNET were to take place in collaboration with PADIS.

In the mean time, the coordinator of COMNET-IT, embarked upon developing an understanding of the state of electronic networks in Africa. This was created from a number of sources: documents of electronic networking projects, conference proceedings and word of mouth. In particular, the assistance of a freelance consultant on electronic networking who was responsible for a number of the training initiatives carried out under PADIS was a key factor in ascertaining a more realistic set of requirements for GOVERNET. The research made it clear that in all but one of the countries identified

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for GOVERNET, there existed a FIDO host computer or there was the possibility of dialling in to the Internet node in Johannesburg. In effect, this meant that the costs of obtaining electronic mail connections for each of the MDIs was considerably lower than if a separate host were to be established within each institution. It also meant that the way forward for the GOVERNET project was not in collaborating with PADIS, but to collaborate with the individual FIDO hosts and/or with the potential Internet hosts.

Concerns about the security of the network connections and the confidentiality of the data being transmitted persisted among the potential users. Given that host operators had access to the electronic mail messages that were polled through their hosts, it was unlikely that the confidentiality issue would be overcome. A counter argument was that FIDO software has within it encryption utilities that allow messages to be encrypted in a number of ways. In addition, the reliability of FIDO technology appeared to have been tried and tested in a number of sites to the extent that the FIDO connections appeared to be more reliable than the telephone connections.

While FIDONet appeared to be the most appropriate way forward, it limited its users to email. The increased awareness of the potential of electronic networks meant that many users expected to be able to access remote databases (as had been promised by the PADIS project) and have synchronous conferencing. These more advanced facilities were available through direct Internet connections supported by TCP/IP protocols. One way of testing the waters was to provide training in both FIDO and Internet technology to a varied group of participants. A workshop funded by the Commonwealth Secretariat and hosted by COMNET-IT's Technical Assistance task force set out to do just this. It also undertook to teach the broader implications of IT Policy.

The COMNET-IT Workshop

The COMNET-IT Workshop was a pan-Commonwealth initiative sponsored by the Commonwealth Secretariat and held at the National Centre for Software Technology (NCST) in Bombay from the 28th March to the 8 April 1994, under the title of the *COMNET-IT Workshop*. The COMNET-IT workshop set out to train participants on how

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to access the network and use electronic communications to build working relations among a group of geographically distributed professionals. The aim of the workshop was to provide participants with the ability to use electronic mail, but also to provide them with the practical knowledge of how electronic communications technology works and the variety of applications that it offers. While a variety of network applications were covered, the focus was on using and setting up electronic mail connections by hands-on training with a view to building networks of people involved in information technology policies and who could form the basis for a COMNET-IT user group.

The participants were chosen through a selective set of guidelines and procedures involving nominations from point of contacts in all of the Commonwealth countries in which the announcements were sent. From the nominations, a group was 'hand picked' and sponsored by the Commonwealth Secretariat to attend. This group of participants comprised a mixture of high level officials involved in planning and policy making in government institutions, in the MDIs and information technology professionals following careers in government and related institutions. The countries represented in the selected group were: West Indies, St Lucia, St Vincent, the Bahamas, Malta, Tonga, Malawi, the Gambia, Namibia, Nigeria, Sierra Leone, Uganda, Zambia, Sri Lanka, Ghana, Maldives and Seychelles.

The workshop began with a series of lectures and hands on work sessions on the mechanics of networking given by technical staff of the NCST. An initial focus was provided on the need for networking and related introductory concepts. Then the workshop progressed towards building the technical knowledge and skills of the participants. Applications and general hands on experience in logging on to the gopher and other Internet resources along with some in depth training on FIDONet and Waffle (a software that enables a personal computer to talk to an Internet host) were provided. For the group of participants who represented African and Caribbean countries (where the scarcity of direct Internet connections restricts networking options) the sessions on FIDONet generated much enthusiasm.

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In addition to building a level of technical skill, a 'how to join the network' starter pack was given to the participants. The starter pack was the product of the combined expertise of the NCST and the GOVERNET project. The participants had gained enough working knowledge on Waffle and FIDONet software during the workshop to be able to use the pack to set up their own email connections. These general training sessions were then followed by parallel sessions of more specialised training in electronic networks, and of more abstract sessions on the nature of IT policy and strategies for implementation of IT policies. In the technical electronic networking sessions TCP/IP protocols, X25 technology and setting up Internet connections were taught. In the parallel IT Policy sessions, there were a set of visiting speakers renowned for their role in IT policy and planning in India. However, the participants from the higher echelons of government for whose benefit the IT policy sessions were taking place turned out to be more interested in the sessions on X25 and TCP/IP protocols and setting up Internet connections. Both parallel sessions were well attended but it was interesting to see that the technical sessions had a devout core of participation which was significantly higher than that of the IT Policy sessions. In between the training sessions, the participants presented material they had prepared on IT policies and the state of information technology and electronic networking in their respective countries. The participant presentations generated a great deal of insightful exchange of experiences concerning the state of their respective institutions and countries.

A significant concern which transpired from these discussions, and was shared by the African and Caribbean information technology professionals working in government departments, was about foreign consultants sent in by international agencies. While the foreign consultants brought with them technical expertise and equipment, they were often incapable of dealing with the issues of developing information systems in these countries. As a result local practitioners would end up implementing the project, writing the relevant documentation and providing the training, while the foreign consultants would receive the credit and high salaries paid by the local governments. This concern over foreign consultants appears to have focused the attention of the participants on attaining as much technical skill as possible. For the information technology professionals

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knowledge of electronic networking meant that they could claim a certain degree of independence from foreign consultants. For the government officials an understanding of the technicalities of electronic networking appeared to be a safeguard against being dependent on technical experts (local or foreign).

Recapitulation and Comparisons

So far, the case study has been presented as it stands: a loosely defined network of varied and geographically dispersed activities held together by an administrative coordinating function. The context within which COMNET-IT has come into being is an uncertain, complex one requiring a flexible organic structure to support it. This network has also given rise to two very distinct networking initiatives which are still in their formative days and their success or failure cannot be judged on the basis of their development thus far. As there were at the time no initiatives such as COMNET-IT with which it could be compared, certain characteristics of networking have become apparent and can be used to draw comparisons between COMNET-IT's networks and to other initiatives that demonstrate these aspects of networking.

This section summarises aspects of COMNET-IT and compares characteristics of ICGITD and GOVERNMENT using the five levels of networking. It isolates salient features of networking and explores these at each level highlighting areas that may require further investigation either in this dissertation or in future research. In particular, the stage is set for a more rigorous investigation of networking.

Technology

Electronic communications technology plays a significant part in the COMNET-IT network and its networking initiatives. The technology forms the basis upon which communication takes place. It facilitates meetings for the COMNET-IT steering group, consultation and collaboration for the ICGITD and the exchange of material on administrative reform programmes in GOVERNMENT.

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Structuring discussions

The ICGITD Discussion Board in the COMNET-IT Notice Board provides a means of structuring discussions and a forum of consultation in which potential collaborative projects may be identified. The way in which the discussion board facility operates is similar to a well structured electronic news group in which topics for potential discussion and debate are posted. These asynchronous discussions need to be moderated so that topics are posted under relevant headings and errors and/or superfluous items removed. The information contained within the discussion board is only accessible to ICGITD members. The system automatically signs the names of users on comments that they enter and ensures that only a creator of a comment may delete or modify it. The system is accessible by authorised users and operates on a high security machine at the ULCC; the information contained within the discussion board is seen to be secure.

Email and asynchronous computer conferencing

In contrast to the COMNET-IT steering group and the ICGITD, the GOVERNET project primarily utilises a low cost FIDO technology to enable its users access to email and asynchronous computer conferencing. This technology utilises PCs, modems and telephone lines to enable messages to be transmitted from one user to another. The FIDO software has been developed to suit local conditions and is seen to be more efficient than faxes or even long distance telephone calls as it is able to cope with faulty telephone lines and fluctuations in electricity. While it is relatively easy to obtain an email connection, such email connections rely heavily on the technical support of local system operators who have been known to read messages before transferring them to their destinations. While the security of FIDONet connections may be dubious, encryption facilities are available to users who require confidentiality.

Work process

The COMNET-IT work process is a distributed work process which comprises multiple organisations representing different skills and resources. Its work process has enabled COMNET-IT to carry out a variety of projects which draw upon different specialisations. Notable components of the COMNET-IT work process may be seen to be electronically

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supported steering group meetings, face to face business meetings and informal discussions.

Sharing skill and expertise

The COMNET-IT work process may be seen to draw upon the different skills and expertise of the task forces and upon the resources of their organisations, and of the Commonwealth Secretariat. Relevant skill and information are also shared among members of the ICGITD, but not to the extent that there are any ongoing working relations among the members. Unlike the COMNET-IT steering group, the ICGITD work process concentrates on exchanging information with a view for possibilities for collaboration. In GOVERNET the purpose of the work process is to share expertise and experiences in administrative reform programmes and appears to have a clearer focus than in the ICGITD but less direction than in the COMNET-IT steering group.

Functional and geographical distribution

The COMNET-IT work process is particularly heterogeneous in that it is both multi-functional and multi-locational requiring coordination mechanisms to enable the work process to operate effectively. Communication among the task forces is necessary in order enable such a work process to operate. Additional coordination mechanisms are required to facilitate the dissemination and diffusion of information and resources between the task forces and the Commonwealth Secretariat. At the same time, the GOVERNET work process is multi-locational but not multi-functional in that the MDIs share concerns relating to administrative reform and are involved in training civil servants. Similarly, members of the ICGITD are located in different parts of the world and share similar concerns relating to information technology for development.

Supported by electronic communications technology

Electronic communications technology is seen to support coordination among the task forces in COMNET-IT, as well as communication, sharing of information, expertise and resources in GOVERNET and the ICGITD. The technology provides a means of accessing skill and resources of different organisations around the world by making it

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easier to communicate and providing a forum for consultation and collaboration. In this sense the technology is seen to enable the spatial and temporal distribution of work (Jones 1991). In supporting a flexible work process the technology is seen to enable a fluid, adaptable work environment.

Organisation

While it is difficult to envision COMNET-IT as an organisation in the traditional sense, it does possess certain features of an organismic form of organisation as described by Burns and Stalker (1966). In addition the existence of coordinating mechanisms, decision making and information processing features provide COMNET-IT with a distinct identity. These points are explored in the following sub-sections.

Structure

The structure of COMNET-IT is seen to be organismic in that it does not rely on a hierarchical structure of control and communication. It is team based in that the steering group works together to achieve joint initiatives. COMNET-IT is composed of autonomous inter-dependant units which have the flexibility to operate in a changing environment. It also has the fluidity to spawn new networks and support the development of networking initiatives from a widely dispersed network of task forces. The structure of COMNET-IT is built upon a network of relations among people and organisations. In terms of Child's (1988), criteria we find that the extent to which the structure of the network contributes to the successful implementation of plans is not as Child suggests, by formally allocating people and resources to the tasks which have to be done, but by providing mechanisms for their coordination.

Coordinating mechanisms

This very diffused, geographically dispersed structure requires certain very distinct, mechanisms for coordination. These mechanisms are heavily supported by information technology. The COMNET-IT steering group's meetings are supported electronically, but the task forces also require administrative and financial support which were provided at the time by the Commonwealth Secretariat. Coordinating mechanisms in GOVERNET

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are more dispersed in that the responsibility of coordinating the administrative reform network is shared between the MDI's, AMTIESA and the Commonwealth Secretariat. In contrast, the ICGITD is coordinated almost entirely using email and the COMNET-IT Notice Board.

Decision making and information processing features

In attempting to identify what provisions are available for assisting decision making and associated information processing, we find that the COMNET-IT steering group meetings serve as a means information sharing and are intended to enable decision making. The ICGITD uses COMNET-IT's electronic notice board to provide it with a forum for ongoing discussion with a view to decision making, while in GOVERNMENT, the network structure is used primarily as a means of information sharing among the MDIs. Still, it remains to be seen if the network is able, to support decision making and what sort of information processing takes place.

Association

The structure of COMNET-IT, and its task forces, represent an association of people in different organisations who collaborate on COMNET-IT projects and perform COMNET-IT activities. Although the value of electronic communications is significant in forging closer ties among the task forces, it is not the only force. Conferences, and workshops are nonetheless meaningful components of the development of COMNET-IT associations.

Forging alliances

COMNET-IT represents a means of forging alliances and professional working relations. In particular, the COMNET-IT Workshop brought about networking among people involved to various degrees in the use of electronic communications technology. This activity presented itself as means of building associations among people from different organisations particularly between the African and Caribbean countries of the Commonwealth. Contrary to expectations, the common ground that led to the creation of these associations were not the IT Policy sessions at the COMNET-IT Workshop, but

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technical networking sessions. The reason for this was that the majority of participants shared concerns over their respective institutions' (and countries') reliance on foreign skill in electronic networking. Although this was not its main purpose, the Workshop served to bring together people with common concerns and not necessarily a network of professionals interested in IT Policy.

Professional and Institutional Linkages

In COMNET-IT, facilitating the exchange of information, access to expertise and resources using electronic networks is seen to foster and enhance professional and institutional linkages. The Commonwealth Secretariat's relations with people in organisations working on joint projects are strengthened with ongoing work processes among task forces representing specialised functional areas. As most of the work processes in COMNET-IT are electronically supported, the technology enables existing linkages among people and organisations to be exploited. In particular, it enables the information resources (ie databases) of institutions to be accessed by other institutions linked to COMNET-IT.

In the case of GOVERNET, information sharing is seen by the Commonwealth Secretariat to benefit the MDIs and hence their ability to provide better training. The French RIO and the Healthnet projects are also a response to a perceived need for networking among people and institutions and like GOVERNET, make use of electronic networks to support information sharing. In addition to exploiting existing linkages, the technology is seen to create new linkages as in the case of ICGITD where a set of donor agencies find areas for collaboration while interacting on the COMNET-IT Notice Board. New associations formed through exploiting existing linkages are perhaps a means by which COMNET-IT may be seen to spawn new networks. Investigating further the process of building associations using electronic networks may throw light as to how existing linkages are exploited to spawn new networks.

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Information partnering and mobilising resources

COMNET-IT may best be seen as an association in which task forces have partnerships through which they are able to draw upon the resources of each others' organisations and mobilise these when carrying out joint projects. The associations embodied the by ICGITD and GOVERNMENT projects are about working together and sharing resources where appropriate. While the ICGITD is not a tightly knit commercial network, it is similar to an information partnership as described by Konsynski and McFarlan (1990), in that it involves collaboration on projects and pooling resources. Unlike the information partnership described by Konsynski and McFarlan, the arrangements between the MDIs in GOVERNMENT are less formal and do not require the MDIs to jointly dedicate resources to service their partnerships. The resources shared in GOVERNMENT are less tangible, relating to training material, workshop proposals and expertise. In view of these varying considerations, it would be worth investigating the extent to which associations are conducive to information partnering, and mobilising resources.

Society

In considering the bigger picture in which COMNET-IT has arisen and spawned GOVERNMENT and the ICGITD one cannot overlook the context of administrative reform. Within this context, the affect of the use of IT should be considered and emerging issues identified. Similarly, when considering information sharing, access to expertise and resources of a group of institutions and geographically dispersed networks for consultation and collaboration, it is necessary to consider societal implications.

Public Administration Reform

A major problem affecting public administrations throughout Africa are the structural inefficiencies that render the bureaucracies incapable of carrying out their functions (Mutahaba 1989). In his work on the economic recovery of Africa, Richard Sandbrook (1993, p.46) provides evidence to support the view that administrative capacity in public administrations is affected by two processes:

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One is the politicization of the bureaucracy attendant upon a growing resort to patrimonial mechanisms of rule. The other is the squeeze placed on salaries, prerequisites, and facilities of civil servants as revenues shrink and external agencies press governments to reduce budget deficits. Both processes, unless carefully managed, vitiate administrative effectiveness.

Sandbrook (1993) paints a picture of the 'presidential-monarch' who treats the administration as his personal property, where he or his lieutenants select the top administrators on the basis of personal loyalties and assign tasks as they see fit. Corruption and arbitrary behaviour of officials is permitted provided that this does not breed rebellion. An acute dilemma is identified: in as much as patronage is wasteful and fosters incompetence and unpredictability, if patronage is severely reduced, governance would rest more heavily on repression, bringing about greater human suffering and undermining an already tenuous national integration. The balance between political stability and corruption in public administration is the precarious condition in which most African countries find themselves and indeed cannot break away from.

Concerted effort - shared responsibility

Reforming public administrations in Africa has become a major concern of most African governments and of international agencies such as the World Bank and the Commonwealth Secretariat. At a Commonwealth roundtable held in London in June 1991, on *The Changing Role of Government*, there was considerable debate on the World Bank and IMF policies of structural adjustment, and the politics of privatisation of state-owned enterprises and the restructuring public services. This took place in a new spirit concerned with the changing role of government and need for reforming public administrations throughout the Commonwealth countries. These included sweeping changes in the structures of government involving massive decentralisation and layoffs combined with programmes for training civil servants for improving administrative performance. A significant criticism put forward by Mutahaba (1989) of approaches to administrative reform is that they place too much emphasis on developing the administrative system at the cost of neglecting other elements of the social system.

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Although the administrative system may have been improved with better qualified personnel and tidier organisational structures, the environment remains comparatively underdeveloped and brings about dissonance between the administrative system and other components of society.

In order to achieve effective administrative reform, Sandbrook (1993) proposes dramatic changes in the political capacity at two levels. First, is the ascendancy of a reformist regime which inspires trust because it breaks with the corrupt and despotic practices of the past. The second, a shift from mercenary payoffs and force as a primary basis of government. This remains consistent with the new principle for reform proposed by the United Nations Economic Commission for Africa and the World Bank. Known as *people-centred development*, this concept is about making Africa rely more on its own resources and the ingenuity and energy of its people to produce goods mainly for the consumption of its own people in expanded common markets (World Bank 1989, 1990). However, Sandbrook (1993) suggests that with the lack of a politics of transition, this option may become utopian. He states that empowering people challenges power structures. This has been illustrated by the suspicion of governments against Non Governmental Organisations (NGOs)⁸.

Use of information technology

The role of the GOVERNET project in providing a group of civil servants access to electronic communications technology exposes the potential of this technology to a group who have been previously unaccustomed to it. And yet, there is considerable resistance to the use of information technology, in particular to the 'hands on' use by senior officials. According to Wesley-Tanaskovic (1985), administrators in government and other top managerial positions are a category of potential users that do not access the available

⁸ The Kenyan government in 1991 felt sufficiently concerned about the activities of non-governmental organisations to establish a statutory board to monitor and regulate them. In short, governments will not adopt a participatory needs-oriented approach simply because it appears to have altruistic motives with respect to the long term interests of their poor majorities. This is not to say that participatory needs-orientated policies necessarily translate into projects that alleviate poverty and foster self reliance.

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information services. The leaders do not bother to utilise the formal information services of the national system that they have decided to set up and have invested public funds in. In most cases, they prefer to rely on the long standing tradition of interpersonal exchanges and direct oral or written information transfer, undoubtedly, she claims, the most effective way of obtaining the latest appropriate information (of the requisite quality and quantity) which can be applied with a minimum of delay and expense. She states that (Wesley-Tanaskovic 1985, p.48):

It appears that when setting up information systems in most countries, the emphasis has been placed on the supply of information services rather than on mobilising anticipated demand. This difficult task involves teaching the basic skills of finding and handling information; acquainting users with the sources of information that they require in their professional tasks and daily occupations; updating researchers, educators and practitioners as well as generally stimulating the habit of seeking information and using it effectively.

At the same time, public administration has been one of the first areas to have begun using computers. In particular, some of the earliest installations in Africa date back to the 1960s. Many of these have been provided by donor agencies⁹.

Emerging issues

Within this big picture, the role of COMNET-IT is as a facilitating mechanism for organisations having to face the above social, political and economic dilemmas. By facilitating consultation and collaboration, the ICGITD is enabling concerted effort and shared responsibility among a group of donor agencies. In the context of Administrative

⁹ It was reported by a senior official at the Pan African Development Information System, Herbert Girkes (1993), that in a particular African country, the ministry of Agriculture works with FAO databases complying with that technology, while the planning ministry that is supported by the European Community, uses European equipment and the ministry of Health has a bi-lateral project with USAID and follows the rules decreed by the American Government. These observations are supported by country surveys of information technology in government (in Commonwealth Secretariat 1988).

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reform in Sub-saharan Africa, the issue remains one of empowerment. Indeed, linking up key people in management development institutions will enable greater communication and collaboration, the consequences of which are yet to be seen. The question is not whether electronic communications technology will be used, but whether the consequences of its use will be as Sandbrook suggests "of building the social power of civil society" or in fact increasing the likelihood of abuses of power ?

Synthesis and Conclusions

In this chapter, a case study is presented which encompasses three networks. The COMNET-IT network is seen to represent a group of activities which use electronic communications technology to facilitate communication and collaboration. In theory, the networking initiatives of the ICGITD and GOVERNET are intended to enhance communication and collaboration. In practice we find that while the technology may be used extensively, it may not necessarily be used to attain the greater goals of administrative reform. Still, electronic communications technology is seen to support a network form which is in its formative stages.

The agility with which resources can be mobilised and coalitions formed makes this network a force to contend with. The network structure is often portrayed as based on 'democratic' principles allowing greater participation and interaction for those who have something to contribute in terms of their experience and information. And yet, from the case of COMNET-IT, it seems that the forces that drive a network are information sharing but also a need to tap the resources of different organisations and to mobilise coalitions from a geographically dispersed group of people. From here we turn to an investigation of how this network form actually works. In the following chapter, the electronic steering group meetings are investigated further in the light of the forces which drive the network form.

There is an imperialism of culture which is harder to overcome than the imperialism of power.

Bertrand Russell

Chapter Six:

The Dynamics of COMNET-IT (An analysis of its behaviour)

Chapter Six: The Dynamics of COMNET-IT (An analysis of its behaviour)

Introduction

This chapter analyses the steering group meetings of COMNET-IT and presents empirical evidence from which to draw insights on some aspects of the networking phenomena presented in chapter five. The steering group meetings are investigated in greater depth using tools from social network analysis to obtain a more focused image of the structure of the network and the way in which it operates based on transcripts generated from the electronic steering group meetings. Investigating the transcripts entails generating empirical data from which different types of interactions take place, and how these contribute to the development and identity of the COMNET-IT network, are uncovered.

Network structures are explored in terms of the behaviour of actors. These behaviours are then examined by looking closely at the patterns of relations that occur among the actors. In doing so the way in which the technology is used to support the sharing of information, skill and resources becomes evident. Aspects of network structure relating to mechanisms for decision making, coordination of activities, consultation and collaboration are also investigated using the approach developed in this research. According to the basic tenet of network analysis, it should be possible to observe different types of networks within a given set of relations. This means that actors occupying certain roles and who are involved in a given set of relations, may also be part of other often overlapping networks for exchanging resources, sharing information and shaping collective action. These are described in detail further on in this chapter.

From the data of behaviours on the electronic social space, emerging patterns of relations and the structure of the network are identified. The evidence presented by investigating the meeting transcripts is analyzed using the approach of levels and is related to other studies and theoretical approaches. As a result, certain generalisable conclusions that may apply to other contexts are drawn. The ensuing propositions are used to identify network characteristics, and suggest further implications for networking.

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Investigating the Electronic Steering Group Meetings

When investigating electronic meetings it is necessary to consider social structures, their development and influence on the behaviour of actors. Structuration theorists see social structure as meaning which is created in the ways in which actors perceive reality and enact their perceptions of reality. Social structure is recognisable in dependencies of power, cultural considerations and various contextual constraints (Monge and Eisenberg 1987). The structuration perspective proposes an emergent view, in that there are deep structures of power, and influence which constrain human action and the patterns of relations that emerge. At the same time human action helps to shape and define social structure (Giddens 1984). Structures of leadership, power, and domination manifest themselves in relations among social actors creating patterns in their behaviour. Patterns of behaviour that emerge on electronic group meetings are the basis upon which it is possible to investigate networks of people and organisations. The analysis of this chapter, uses Linda Harasim's term, *social space* to describe the way in which human communication has transformed computer networks into what she calls 'places' where people 'connect' with each other. This research takes the notion of the social space as described by Harasim (1993) a step further by considering the social processes that affect interaction on the electronic medium of communication. It recognises that the technology may have an affect on the social processes and thus the patterns of relations and behaviours that emerge. Hence the term, *electronic social space*, is used to describe the environment in which the network phenomena are investigated. This notion of the creation of social structure on the electronic medium of communication provides us with a basis upon which to tackle the vaguer more complex aspects of human interaction which are nonetheless significant components of networking.

In considering the structure of relations, structuration theory appears to lend itself particularly well to the interpretation of how the structure of a network and its behaviour produces and reproduces social systems. An application of structuration theory to computer mediated communication is offered by Poole and DeSanctis (1990). They propose a 'Theory of Adaptive Structuration' which states that as group members use GDSS to complete a task, they develop and apply rules and resources for the conduct

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of their own behaviour. The rules and resources of the group direct members as to which features of the technology they should appropriate. They found that when individuals in a group interact using GDSS, each group produces and reproduces its own *structures-in-use* by which they use the technology to suit their own purposes. This process, they claim, accounts for a continual changing nature of social structures involved in the use of group decision support systems. A shortcoming of this model, according to Fulk *et al.*(1992), is that it establishes a framework which does not easily lend itself to empirical examination.

A slight shift in theoretical rationale is therefore warranted. In accordance with Gibson's mode of analysis (1991), it is considered inappropriate for this research to attempt to test any one particular theoretical model or set of hypothesis that would exclude other perhaps more appropriate variables that were not considered earlier. In this investigation, structuration theory is used as a *meta-theory* in that it sensitizes this analysis to the social forces considered. The theoretical tools and techniques of social network analysis, described in chapter four, enable an analysis of empirical data. There are essentially two ways in which the theoretical constructs from social network analysis may be used to investigate networking. The positional approach may be employed to investigate the network as a formally defined set of positions and roles. As this approach provides a static view of network structure, it is necessary to consider communication relations using the relational approach. The relational approach views structure as dynamic and motivated by individuals and may be used to investigate emerging interactions or bonds among a group of people. In the following two sections, both of these approaches are considered briefly in the context of COMNET-IT.

Positional approach

Using the positional approach, actors are viewed according to the roles that they occupy with respect to the other actors on the network. Following the positional approach network structure may be described by identifying roles human actors occupy (ie, doctor, nurse, technician); these roles are seen to persist despite changes in the individuals occupying them. In the case of COMNET-IT, the Technical Assistance task force leader and the Directory and Partnership task force leader both occupy similar positions on the

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steering group as they are both leaders of task forces. The position of a particular actor is associated with sets of rules and regulations which affect conduct and ways of working on the network. This approach to network analysis is particularly useful when considering the formal structure of the network and its mechanisms for coordination. In this way, insight may be gained into aspects of network structure which relate to leadership, control and allocation of responsibilities and resources.

Relational approach

Using the relational approach, actors are viewed in terms of the relations that they have with other actors on the network. This approach enables sets of common linkages, also known as *cohesive linkages*, with other actors on the network to be identified. In the COMNET-IT steering group meetings, the relational approach enables an understanding of the linkages that exist among steering group members. These may also be observed among certain members who share common sets of linkages with people outside COMNET-IT. Using the relational approach, it is possible to obtain an understanding of the dynamic, informal links between actors. In particular, influential relations affecting collaboration, and access to resources and information can be identified.

In this analysis, both of the above approaches are used interchangeably. The positional approach is used to determine the structure of the network by considering the roles of the actors and the activities in which they are involved. Using the relational approach, the links between actors are analyzed in terms of the behaviours that they exhibit. In the words of Monge and Eisenberg (1987), "formal and emergent networks coexist, and each can best be understood in the context of the other".

Data Analyzed

The Meetings

Data from three steering group meetings were available for this analysis. The first meeting took place in September 1993 at 3pm (GMT) and lasted just under two hours. This was attended by a total of four members. These were the Commonwealth

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Secretariat Representative, and three task force leaders: Technical Assistance, the Directory and Partnership, the Publications and Newsletter. Due to technical problems, the coordinator was unable to attend the first meeting.

The second meeting took place in October 1993 at 2pm (GMT), and lasted three hours. This was attended by a total of five people. These were the Commonwealth Secretariat Representative, the Coordinator and three task force leaders: Technical Assistance, the Directory and Partnership, the Publications and Newsletter. The third meeting took place in January 1994 at 10am (GMT) and lasted two hours. This was attended by a total of five people. These were the Commonwealth Secretariat Representative, the Coordinator and three task force leaders: the Technical Assistance, who made a brief appearance, the Directory and Partnership, the Publications and Newsletter.

The system operator at the ULCC (where the COMNET-IT bulletin board is run) was present at all of the above meetings. He was helpful in dealing with technical problems and with providing on line assistance with the complexities of the bulletin board software.

The Transcripts

The transcript of the first steering group meeting appeared to have set the basic form of interaction among the steering group. Of all three meetings, the transcript of the first steering group meeting was most indicative of the:

- 1) way in which the members learn to use the technology
- 2) emergence of behaviours, and
- 3) creation of a structure within which to communicate.

The first steering group meeting was also the only meeting in which the coordinator, also the researcher, was not a participant but was following the discussion in the Commonwealth Secretariat Representative's office.

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Coding the transcripts

In view of the above, the transcript of the first steering group meeting was coded in order to extract the behaviours that were exhibited by the participants. The purpose of coding and analyzing transcripts of the electronic steering group meetings was to obtain a picture of the types of relations that took place and the role of the actors in these relations. The behaviours demonstrated by the actors and the frequency with which these behaviours occurred were used to determine the prominence of certain actors. With an understanding of the centrality and prestige relations, additional properties of the network, such as the level of stratification of the network could be explored.

From the transcripts (raw data) of the electronic meeting, a list of types of behaviour were identified and coded according to information exchange behaviours suggested by Rubin and Goldberg (1992). Basic communication relations of information providing and seeking were coded as IP and IS respectively. In trying to understand who initiated and who participated in these behaviours, additional behaviours were identified in the transcripts and suitable codes formulated to depict the behaviours. These are requesting action, coded as RA, confirming action, coded as CA, and seeking consensus, coded as SC. These behaviours are termed by Rubin and Goldberg (1992) as *contractual relations* in which an actor sends a message to another in order to obtain a response. Further behaviours defining contractual relations were identified in the transcripts. These are: statement of a problem, coded as SP, statement of a solution, coded as SS. Behaviours that gave an indication that there was an outcome from the discussion are: making a decision, coded as MD, Notifying that an event has occurred, coded as NE, and volunteering assistance, coded as VA. These behaviours are illustrated in table 1.

A particular feature of the steering group meeting was a set of behaviours relating to funding. It was in this set of behaviours that the various members' expectations and contributions surfaced. Behaviours relating to project funding that were identified were: raising funds, coded as RF, seeking funds, coded as SF, and providing funds, coded as PF. An additional significant behaviour was reference to other people outside COMNET-IT. This behaviour was coded as OP. Humour, coded as H, was also an indicative feature

Table 1: Key to Codes

Types of Behaviour		Attributes	
IP	Information Providing	(T)	Technology
IS	Information Seeking	(W)	Work
RA	Requesting Action	(O)	Organisation
CA	Confirming Action	(A)	Association
SC	Seeking Consensus	(S)	Society
SP	Statement of Problem		
SS	Statement of Solution		
NE	Notifying occurrence of Event		
MD	Making a Decision		
VA	Volunteering Assistance		
RF	Raising Funds		
SF	Seeking Funds		
PF	Providing Funds		
OP	Other People		
H	Humour		

of the behaviour of the members. Every time the subject of the conversation changed to a new agenda item, an AI was placed next to the name of the member initiating the discussion on that topic. Agenda items (AI) alone were not considered to be behaviours and are thus not included in table 1.

In themselves, the codes for behaviours defined above are simplistic. They do not tell us about the context within which they occur and may often be interpreted in more than one way. In order to be of value to our analysis, these behaviours must be considered in terms of the type of networking taking place and in terms of the actors exhibiting the behaviours. In view of this, the behaviours were then qualified with attributes defining the five levels of networking. As described in chapter one, these relate to the network which is seen to comprise of communications technologies (T); a work process which, in particular, can transcend space and time and is enabled by technologies (W), organisational functions (O), associations of organisations (A) and societal considerations (S). These are also illustrated in table 1. An analysis of the behaviour of the actors on the network presented within this layered model and further developed by the use of concepts drawn from social network analysis, is carried out further on.

In order to protect the privacy of the actors involved in the steering group meetings, their

Table 2: An example of a coded transcript

#AI	
#IP(W)	
#Comsec	(') <i>If we continue - even though we are only 2 (+ Coordinator over my shoulder)</i>
#Comsec	(') <i>the first item I wanted to raise was the proposed programme for the</i>
#IP(T)	
#NCST	(') <i>I believe that IIM will come back</i>
- #Comsec	(') <i>network of research institutions and the how to join the network pack</i>
- #Comsec	(') <i>I assume that all is going well - and that the discussions with M.</i>
- #Comsec	(') <i>will clarify any points</i>
#OC(W)	
#NCST	(') <i>OK. I was glad to hear that you think the programme sounds good</i>
#IS(W)	
#Comsec	(') <i>did you get the material from ML - from Rhodes University - he</i>
#Comsec	(') <i>was claiming to have some relevant 'how to join' material and software</i>
#CA(W) #OP(A)	
#NCST	(') <i>Yes. I am sure that any clarifications necessary can be</i>
#NCST	(') <i>handled over the phone to M.. If he is passing through Bombay</i>
#IP(T)	
#sysop	(') <i>ok - ULCC will be on in a moment</i>
#sysop	(') <i>he will be using my account as he can't use his own</i>
#CA(W) #OP(A)	
#NCST	(') <i>it will be even better. I can have a half-an-hour discussion with him</i>
#NCST	(') <i>and iron out any problems that remain.</i>
#CA(T)	
#Comsec	(') <i>one point that needs tidying up - the 'say' prompt should be followed by</i>
#Comsec	(') <i>about 4 lines for text - it is disconcerting to have half a thought sent</i>

names were replaced with the names of their respective institutions. This was consistent with the fact that the task force leaders represented their organisations and could be analyzed using the positional approach as they occupied similar positions on the steering group. For example, the leader of the Directory and Partnership task force was coded as ULCC in this analysis, the leader of the Technical Assistance task force was coded as NCST, the leader of the Newsletter and Publications task force was coded as IIM and the Commonwealth Secretariat Representative was coded as Comsec. The transcript of the first steering group meeting was prepared according to this schema and analyzed

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using a tool constructed for the purpose of extracting patterns of relations and their behaviour. Every time they spoke, a hash (#) was placed next to their coded names such as #NCST and a relation describing information providing was coded as #IP. The attribute for this relation could be any of the five types of behaviour described in the layered model of networking. It could be work behaviour coded as W, in which case the relation #IP and its attribute W are coded as #IP(W). While a major part of the text in the transcript was coded to identify behaviours and their attributes, some of the text depicting politeness and noise was coded according to behaviours exhibited but left without attributes. The coded transcript prove to be particularly useful in highlighting the prominence relations that influenced behaviour on the steering group. Both measures of centrality and prestige were used in the analysis. An example of the coded transcript is illustrated in table 2. In this analysis the participants of the electronic meeting are also referred to as actors.

Constructing an analysis tool

An attempt was made to find an appropriate tool to enable simple and sophisticated searches of the coded transcripts. A number of qualitative data analysis packages were tried including, a PC based, ZYNDEX and a network implementation of NUDIST. In particular, NUDIST was used to build a project categorising the various elements of the transcripts. It presented the data in an ambiguous, obscure manner that could be interpreted in a number of often contradictory ways and turned out to be inadequate for representing the behaviours of actors and their relations as its searches and hierarchical representations prove to be inappropriate for the purpose of this investigation.

In order to be able to extract successfully the salient features of networking on the steering group meeting, it was necessary to build a tool that would enable an analysis of social networks. As a result, the author constructed a Hypercard tool for the particular purpose of:

- 1) searching the data in the transcripts for number of occurrences of particular behaviours, and

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- 2) linking these behaviours to particular actors.

Using the Hypercard scripting language, it was possible to build into the analysis tool specific features enabling the author to draw from the transcripts, data on relations among the network of social actors. In particular, it was possible to investigate the centrality and prestige relations that took place on the electronic social space. Additional features of the analysis tool include the ability to index searches of parts of a meeting transcript and compare these with indexes of searches done on similar parts (ie discussion of agenda items) of the transcripts of the other meetings.

Results

The initial results from the Hypercard tool are presented as a list of behaviours demonstrated by each actor. This provides an indication of the frequency or intensity of communication, which from the relational perspective, means that the members are linked together by some criterion of cohesion. From the positional perspective, this data enables the researcher to identify members who are structurally equivalent. As discussed in chapter four, members are considered to be structurally equivalent when they have the same (or similar) patterns of relations as other members on the network. The link data in table 3, provides a picture of the types of behaviour exhibited by four actors occupying similar positions on the COMNET-IT network.

Table 3 tells us that of the many different types of behaviour exhibited, there were a few behaviours which occurred most frequently. From the relational perspective this provides an indication of the linkages between members of the steering group. These behaviours are explored further to find out about the level and kinds of linkages members have with people in other organisations. The data in table 3 also indicates that of the four steering group members, two exhibited the most behaviours. In this, the structure of the network appears to be stratified in that two actors are considerably more active than the other two. From the positional perspective, the focus of analysis is on network stratification and can be analyzed using the two concepts of prominence explained in chapter four: centrality and prestige. The structure of a network may be centralised in that all relations

Table 3: Link data

NCST		Comsec		ULCC		IIM	
#RA(T)	1	#RA(T)	1	#H(T)	1	#IS(T)	1
#SP(T)	1	#IS(T)	2	#IS(T)	1	#SC(T)	1
#NE(T)	1	#CA(T)	2	#IP(T)	2	#NE(T)	1
#SS(T)	1	#H(T)	2	#SP(T)	2	#IP(T)	3
#H(T)	2	#IP(T)	3	#SP(W)	1	#SF(W)	1
#RA(T)	2	#SP(T)	9	#SS(W)	2	#H(W)	1
#IS(T)	2	#MD(W)	1	#OP(W)	3	#IS(W)	3
#IP(T)	6	#PF(W)	2	#IS(W)	3	#RA(W)	3
#OC(W)	1	#SP(W)	2	#CA(W)	4	#CA(W)	3
#H(W)	1	#RF(W)	2	#IP(W)	9	#OP(A)	1
#SS(W)	1	#SC(W)	4	#IP(O)	1	#IP(A)	1
#VA(W)	1	#CA(W)	4	#IP(A)	3		
#SP(W)	3	#RA(W)	7				
#IP(W)	5	#OP(W)	8				
#RA(W)	5	#IS(W)	11				
#OP(W)	5	#IP(W)	23				
#CA(W)	12	#SP(O)	1				
#IS(W)	12	#IS(O)	1				
#SP(O)	1	#SC(A)	1				
#H(O)	1	#RF(A)	2				
#IS(O)	2	#IP(A)	2				
#SF(O)	2	#OP(A)	4				
#IP(A)	1						
#CA(A)	1						
#IS(A)	2						
#OP(A)	4						

in it involve a single actor (centrality relations) or it may be hierarchical in that a single actor is the object of all relations in it (prestige relations). In order to develop an understanding of stratification and network structure, searches of the number of times the actors spoke, were spoken to, initiated agenda items, and the number of times actors spoke on agenda items were carried out. The results of these searches are discussed in subsequent sections.

General Patterns of Behaviour

Before considering patterns of behaviour and network structures in detail, it is worth presenting some general observations as the data presented in the following sections is supported by direct observations of the researcher while she was taking part in two of

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the three electronic group meetings. It was clear to the researcher that certain patterns of behaviour had emerged on the electronic steering group. The role of the chairperson was very explicit. Although he was 'democratically' elected to chair the discussion, there was no question about his command over the discussion, selection and time given for debate of the items on the agenda. Although all members did get a chance to air their views, extensive observations revealed that it was the members with projects that made clear progress who had the most to say. In addition, those members who just wanted to air their ideas without making any significant contribution to the discussion found themselves at the fringes of the discussion while the influential members got on with their own agenda. Influence on a steering group meeting was not only associated with the projects that the members were involved in but also their level of contribution to COMNET-IT activities.

In addition, the information that members had access to gave them an element of credibility in the general discussion. Out of the collaborative working links developed among the task forces, it was activities such as training, workshops and the development of the 'how to join the network pack' for linking people up to the electronic network, that had by then formed the core of COMNET-IT. The identity of the project appeared to have been developed along these activities.

Analysis of Behaviour on the Electronic Social Space

When interacting on the electronic medium, members of the network brought with them their own perceptions and cultural backgrounds. The result was, in the case of COMNET-IT, an amalgamation of these norms and perceptions. The electronic communication media presented itself as a somewhat alien environment. In this respect, moderating a meeting was seen as an ordeal as the participants were not accustomed to communicating without the turn-yielding cues available in face to face communication. In addition, the electronic medium presented itself as a new environment in which different ways of working, communicating and cultural norms had to be reconciled. For example, there were some very sensitive cultural norms that had to be adhered to when addressing the oriental participants but at the same time it was necessary to maintain a

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level of directness in order to enable productive discussion and avoid misunderstanding. When considering interaction on the electronic media, an electronic social space is explored in which a set of norms and perspectives develop and become accepted within the group. Within the electronic social space this analysis considers patterns of relations and behaviours that are formed as a result of these social processes.

Type and level of linkages

In exploring the different types of behaviour, this analysis examines the content of *multiplex*¹⁰ linkages that have emerged on the electronic social space. By extracting the different types of behaviours that have emerged on the electronic group meetings and presenting these in relation to the levels of networking, the content of the linkages are identified. The content of a linkage is important because it defines what flows between members and specifies the nature of the network (Monge and Eisenberg 1987). In table 4, the frequency of each of the behaviours identified on the transcripts in relation to four levels of networking is presented. The total frequency of some of the behaviours presented in table 4, is greater than that presented in table 3, as table 4 also includes behaviours demonstrated by the system operator. The system operator's behaviours are not included in this analysis as these were very few and did not influence the members of the electronic steering group. It is interesting to note that despite the far reaching objectives of COMNET-IT, there were no behaviours identified at the societal level of networking.

Table 4 suggests that the behaviours that occurred most frequently on the electronic group meetings were:

- information providing (IP) at the technology level
- information providing (IP) at the work level
- information seeking (IS) at the work level

¹⁰ Linkages that encompass more than one topic area or network are said to be multiplex (Monge and Eisenberg 1987).

Table 4: Behaviour on the network

	IP	IS	RA	CA	SP	SS	OP	RF	SF	PF	SC	NE	MD	VA	H
T	18	6	5		12	1					1	2			5
W	37	29	15	23	6	4	17	2	1	2	4		1	1	2
O	1	3			2		1		2						2
A	7	2		1			9	2			1				
S															
Total	63	40	20	24	20	5	27	4	3	2	6	2	1	1	9

- requesting action (RA) at the work level
- confirming action (CA) at the work level
- references to other people (OP) at the work level, and
- references to other people (OP) at the association level.

Of these seven most frequently occurring behaviours, five took place at the work level of networking and the other two most frequent behaviours took place at the technology and association levels. The number of times other people (OP) were referred to appears to be significant. The exchange of contacts and information on people outside the network was referred to 17 times for COMNET-IT work related issues, 9 times at the association level and once at the organisational level. This indicates that the range of connections between the steering group members and people outside of COMNET-IT is notable and merits further investigation. At the association level these external linkages include individuals and organisations. This suggests that if COMNET-IT is linked to a set of supportive organisations, then valuable resources can be supplied that will help COMNET-IT.

The extent to which there may be an exchange of resources or even resource allocation among the organisations connected to COMNET-IT, is indicated by the behaviours of confirming action (CA), requesting action (RA), raising funds (RF), seeking funds (SF) and providing funds (PF). Behaviours of confirming action (CA) and requesting action

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(RA) are the content of *symmetrical linkages*¹¹ as the relations are directed at mobilising action. This indicates that while these communication linkages took place, action was carried out and resources were allocated among the task force leaders. Further evidence to support this view is provided by the fact that funds were deployed for COMNET-IT activities. Of the two times that funds were sought (SF), the behaviour for raising funds (RF) occurred twice at the work level and twice at the associational level. In addition, providing funds (PF) took place twice at the work level of networking.

It is apparent thus far that work oriented behaviour dominated this network. At the work level, behaviours of information providing (IP), and information seeking (IS), are by far the most frequent and indicate that the content of most linkages relate to information sharing. It is interesting to note however, that the of the 20 times that the behaviour statement of problem (SP) occurred, it occurred 12 times at the technology level, it occurred 6 times at the work level and 2 times at the organisational level. This suggests that there were many problems with the technology (used for the meeting) which required solving. However, only 5 behaviours stating solutions (SS) occurred, of which only one referred to the technology and the remaining 4 took place at the work level. The above data suggests that the electronic group meetings were not conducive to problem solving or even decision making. In fact as illustrated in table 4, only one decision was made and this took place at the work level.

The above suggests that, the electronic group meetings may have been seen by the actors to be a power base through which they could have access to other more powerful and resourceful networks. Although power broking as a behaviour was not identified in the transcripts, names of people and institutions were readily exchanged. In view of this, it is necessary to obtain further evidence of the way in which individual actors are linked (level of cohesion), and to consider the structure of the network and the extent to which

¹¹ A symmetrical linkage refers to the degree to which people enter into the same kind of relationship with each other. As opposed to asymmetrical linkages which refer to superior subordinate relationships, a symmetrical relationship applies to people who talk with instead of reporting to each other.

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the positions of the actors exist in their own right and do not depend on the individuals occupying them (structural equivalence). In the following sections, the nature of the linkages and the structure of the network as it was revealed on the electronic social space is explored in relation to each actor.

Properties of linkages

Table 5 illustrates the way in which the behaviours described in table 4 are distributed according to each actor and the number of times each type of behaviour is displayed by each of the four actors. In considering the most frequent behaviour, information providing (IP), it is clear that Comsec exhibited this the most followed by ULCC and NCST. Comsec exhibited this behaviour seven times more than IIM. It is interesting to consider these behaviours in relation to information seeking behaviours (IS). For Comsec and NCST the ratio of IP to IS behaviours is 2 to 1 and for IIM 1 to 1, whereas for ULCC this ration is 4 to 1. This means that ULCC did not *reciprocate*¹² his information exchange relations to the extent that the other actors did. When considering the ratio of requesting action (RA) to confirming action (CA), Comsec exhibited a ratio of 2 to 1, NCST a ratio of 1 to 2, IIM a ratio of 1 to 1 but ULCC confirmed action on 4 occasions but requested on none. It is worth noting that ULCC exhibited only 6 different types of behaviours compared to 9 behaviours exhibited by IIM, and 11 different types of behaviour exhibited by Comsec and NCST respectively. This suggests that there is a difference in the type of relations each actor was involved in on the electronic meetings.

In table 5, it is clear that resources were allocated by Comsec as he was involved in all of the behaviours for raising funds (RF) and providing funds (PF). These resources appear to be allocated to NCST and IIM who between them demonstrated all the behaviours for seeking funds (SF). ULCC was not involved in any of the funding behaviours. In addition, to allocation of funds, Comsec also stated the most problems (SP) and offered no solutions. This indicates that he may have been responsible for

¹² In social network analysis, reciprocity of a linkage refers to the degree to which two people who are presumed to be linked report the same relationship. In this analysis, reciprocity is used as a qualitative indication of the strength of multiple relations in which many actors are involved in the same relations.

Table 5: Breakdown of Behaviour per Actor

Behaviour	Comsec	NCST	ULCC	IIM	Total per behaviour
IP	28	12	15	4	59
IS	14	18	4	4	40
RA	9	7		3	19
CA	6	13	4	3	26
RF	4				4
SF		2		1	3
PF	2				2
SP	12	5	3		20
SS		2			2
SC	5			1	6
MD	1				1
VA		1			1
OP	14	11	3	1	29
NE		1		1	2
H	2	4	1	1	8
Total per actor	97	76	30	19	224

directing responsibilities to the other three actors. It is interesting to note however, that only NCST responded with two statements of solution (SS). Further evidence to suggest that Comsec had driven the meetings is provided by the behaviour seeking consensus (SC) of which Comsec was involved in 5 out of a total of 6 occurrences. The effect of range on the electronic group meetings is apparent in the way in which behaviours for other people (OP) are distributed across the four actors. Comsec brought into the meetings the most external contacts which occurred 14 times compared to NCST's 11, ULCC's 3 and IIM's 1.

In the above sections properties of linkages among actors have been offered by considering briefly their multiplexity, symmetry, and reciprocity. It still remains to be seen what sets of common linkages (cohesion) have emerged that would enable these actors to collaborate and mobilise resources. It is thus necessary to consider the above

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distribution of behaviours per actor in proportion to the total behaviour of each actor and in proportion to the total behaviour exhibited by each of the four actors. Following an analysis of the proportions in the next two sections, emerging patterns of relations and formal network structures are explored.

Content of each actors' linkages

The analysis of this section considers the content of each actors linkages in terms of the proportion of each behaviour in relation to the total number of behaviours exhibited by each actor. By illustrating the proportion of occurrence of each behaviour per actor, the following table 6, enables features of each actor's involvement to be explored further.

Table 6: Proportion per Actors' Total Behaviour

Behaviour	Comsec	NCST	ULCC	IIM
IP	29%	16%	50%	21%
IS	15%	24%	13%	21%
RA	9%	9%		16%
CA	6%	17%	13%	16%
RF	4%			
SF		3%		5.2%
PF	2%			
SP	12%	7%	10%	
SS		3%		
SC	5%			5.2%
MD	1%			
VA		1%		
OP	15%	14%	10%	5.2%
NE		1%		5.2%
H	2%	5%	4%	5.2%
Total per actor	100%	100%	100%	100%

NB: The above percentages have been rounded off to the nearest percentage

It is clear from table 6, that while Comsec was involved in most of the information providing (IP) behaviours, IP accounts for 29% of Comsec's total behaviour but 50% of

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ULCC's total behaviour. Information seeking (IS) and other people (OP) were second highest in proportion to Comsec's total behaviour. Information seeking (IS) accounted for the greatest proportion of NCST's behaviour at 24% and confirming action (CA) accounted for the second largest proportion. Information seeking (IS) also comprised the second highest proportion of ULCC's total behaviour; it occurred in the same proportion as confirming action (CA) for ULCC at 13%. At the same time, 21% of IIM's behaviour was directed at information providing (IP) and the same proportion was directed at information seeking (IS). Requesting action (RA) and confirming action (CA) came second in IIM's behaviour occurring at a proportion of 16% each.

It is apparent from the above, that NCST was the only actor whose main behaviour was not information providing (IP) and Comsec was the only actor whose second most frequently occurring behaviour was not confirming action (CA). In this regard, there appear to have emerged a set of *asymmetrical* relations between Comsec and the other three actors suggesting that there may be hierarchical reporting relations involved. In order to explore this further, it is useful to consider the extent to which each actors' behaviours comprised the total number to behaviours exhibited on the electronic group meetings. In doing so it is possible to consider the amount of influence each actor had on each behaviour and thus identify any dominant characteristics that may have emerged.

Influence and dominant characteristics

In order to consider the amount of influence each actor exercised on the steering group, the number of times each behaviour occurred for each actor was calculated relative to the total number of times each behaviour occurred. The results are illustrated in table 7.

From examining table 7, it is apparent that while IP comprised 29% of Comsec's behaviour, it formed 48% of the total number of times IP occurred. At the same time, although half of ULCC's behaviour was IP, ULCC only contributed to 25% of the total number of times IP occurred. This suggests that Comsec had a greater impact on IP behaviour than did ULCC or any of the other actors. Similarly, while RA only

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Table 7: Proportion per Total Behaviour

Behaviour	Comsec	NCST	ULCC	IIM	Total %age per behaviour
IP	48%	20%	25%	7%	100%
IS	35%	45%	10%	10%	100%
RA	47%	37%		16%	100%
CA	23%	50%	15%	12%	100%
RF	100%				100%
SF		67%		33%	100%
PF	100%				100%
SP	60%	25%	15%		100%
SS		100%			100%
SC	83%			17%	100%
MD	100%				100%
VA		100%			100%
OP	48%	38%	10%	4%	100%
NE		50%		50%	100%
H	25%	50%	12.5%	12.5%	100%

NB: The above percentages have been rounded up to the nearest percentage

contributed to 9% of Comsec's and NCST's total behaviour respectively, Comsec contributed to 47% and NCST contributed to 37% of the total number of times RA occurred. From table 7, it is evident that Comsec had a distinct impact on behaviours of raising funds (RF), providing funds (PF), statement of problem (SP), seeking consensus (SC) and making decisions (MD). While IS formed 24% of NCST's behaviour, NCST contributed to 45% of the total number of times IS occurred. NCST had a considerable impact on behaviours of confirming action (CA), seeking funds (SF), statement of solution (SS), and volunteering assistance (VA). At the same time it appears from table 7, that ULCC's and IIM's behaviours did not take up a majority of any of the behaviours presented.

The above analysis suggests that two actors exhibit behaviours that appear to have a considerable impact on the outcome of the discussions. Judging from the content of each

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actors' linkages, each actor is involved to varying degrees in different sets of linkages. This means that the discussions did not involve equal participation, and each of the actors exhibited distinct sets of behaviours. Comsec's role was to set the direction for the meetings, request action, seek information and consensus on salient issues and outline problem areas, raise and provide funds. It appears from this that Comsec's was the most dominant role especially since he made the only decision that had been taken on the steering group. NCST's appeared to be the second most dominant role, but his behaviour was directed at responding to Comsec with seeking information, funds, confirming action and statements of solution.

While Comsec's and NCST's behaviours do indicate some common linkages (RA, OP and to an extent IS) implying a degree of cohesion, most of the behaviours were asymmetrical as were ULCC's and IIM's behaviours. This suggests that there is generally low cohesion on this network. As explained in chapter four, in a network where there is low cohesion there is high structural equivalence implying that changes in the people occupying certain roles does not bring about changes in the structure of the network. In the following sections, structural equivalence will be considered using the positional approach and patterns of relations will be identified in order to define the formal structure of this network.

Prominence

Having considered behaviours in terms of the type and level of linkages, the content and properties of linkages, and their dominant characteristics, this section investigates network structures. From an initial analysis of the transcripts, it was clear that there were two actors who were involved in many relations, as explained earlier this means that the network was stratified. By considering network structure, in terms of centrality, this structure can be considered in terms of the number of direct contacts each actor has with other actors and assessed in terms of the number of times that they speak. Prestige relations are identified by considering actors who may be the source or object of relations. One way of identifying prestige relations is by considering the number of times actors are spoken to compared to the number of times they speak. The following table

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8, illustrates the number of times each actor speaks compared to the number of times he is spoken to:

Table 8: Prominence Indicators

	Comsec	NCST	ULCC	IIM	Total
Times spoken	224	128	76	21	449
Times spoken to	14	23	33	21	91
Ratio	17:1	6:1	3:1	1:1	2:1

Table 8 suggests that with the exception of IIM, all three actors spoke more than they were spoken to. This is not surprising as they had to report on their respective activities, voice concerns and shape the direction of COMNET-IT. It is apparent that Comsec and NCST spoke much more than they were spoken to. In particular, the marked difference in the ratio between the number of times Comsec spoke compared to the number of times he was spoken to, is a ratio that when compared to the other actors, is very high. From a centrality perspective this supports an initial observation that Comsec was primarily directing relations between actors.

With respect to identifying prestige relations, the actor to whom the other actors spoke most was ULCC while Comsec, who spoke the most, was spoken to the least. In effect, the prestige relations appear to be directed at ULCC and may be interpreted in two ways: either the other actors were seeking pertinent information from ULCC, and/or they were requesting him to perform certain activities. The types of prestige relations demonstrated by ULCC appear to be different from those of either Comsec or NCST. Unlike the control over funds and authority structures of other organisations exercised by Comsec and NCST, ULCC's influence was by virtue of his expertise. Although ULCC did not talk as much as the central (who also bear a degree of prestige) actors, his influence appears to be borne through his expertise in technical networks.

Prominence may also be described in terms of range. The number of status groups that

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Comsec, NCST and ULCC have access to is of relevance when attempting to determine his social influence. Just as individuals are members of relational networks of people with whom they communicate often, they are also members of networks of organisational units who share similar attitudes and meanings (Fulk *et al.*1992). In the case, of Comsec, NCST and ULCC it is membership of other networks of organisations that enable them to share information and resources that would otherwise be beyond the reach of the COMNET-IT steering group.

Structures in Human Networks

It apparent thus far that the steering group meetings are a forum for resource allocation, driving activities and bringing external contacts to bear on the operation of COMNET-IT. The above suggests that the structure of the network is influenced by behaviours in which both centrality and prestige relations are displayed as well as the range of contacts that actors bring with them. It has been illustrated how the network analysis concepts are applied to highlight features of networking on the COMNET-IT steering group meetings. The concepts from social network analysis guided an inquiry into what patterns to look for in the data. It is apparent from exploring these data on behaviours that certain distinct structures have emerged within the network. These structures manifest themselves as relationships of power, prestige and even simple relations of information exchange. We know that COMNET-IT does not have a conventional organisational structure, but its network structure does have capabilities for coordinating task forces and spawning new networks. This structure may be described in terms of the influence of a certain set of actors on the way in which the network operates. In particular the analysis of the data from the transcripts of the steering group meetings suggests that a distinct set of linkages between the steering group members has arisen. It remains to be seen how this structure works, and what mechanisms exist for coordination, control and access to resources.

In this section, the features of networking highlighted thus far are considered in terms of structures in human networks. The theoretical constructs are applied to provide explanations for patterns in the data and, to an extent, to account for anomalous findings.

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These different network structures are extracted by considering relations according to discussion on activities. By considering relations according to topics of discussion, it is possible to isolate the different types of networks that exist in a given set of relations. Networks of power, resource sharing, and access to expertise and information are highlighted and inferences made relating to salient features of the network form and the forces that drive it.

Multilateral linkages

The transcript of the first steering group meeting was divided according to the main agenda items discussed. Within each section of the transcript, searches were carried out of the main actor responsible for the agenda item being discussed and of the other actors communicating with him on the topic. In particular, the section of the transcript in which the agenda item *COMNET-IT Workshop* of the first steering group meeting was being discussed was put on a single card of the hypercard stack. Specific searches were then carried out for each of the actors. It was found that the main actor who was responsible for the agenda item, NCST, spoke 17 times to Comsec and once to IIM. On the same topic, Comsec spoke to NCST 11 times and IIM spoke to NCST twice. There were also discussions between Comsec and IIM with respect to the COMNET-IT Workshop. IIM spoke to Comsec twice and Comsec spoke to IIM three times. These results are illustrated in figure 1:

As illustrated in figure 1, ULCC did not participate in the discussion on the Workshop as it did not concern him. It is worth noting however that in this network, NCST had the central role of providing information and Comsec's role was to direct relations between NCST and IIM. No prestige relations were identifiable in these relations. This suggests that if the individuals were to be replaced by another technical assistance task force leader, publications task force leader, and another commonwealth secretariat representative, the above linkages for the COMNET-IT workshop would remain the same.

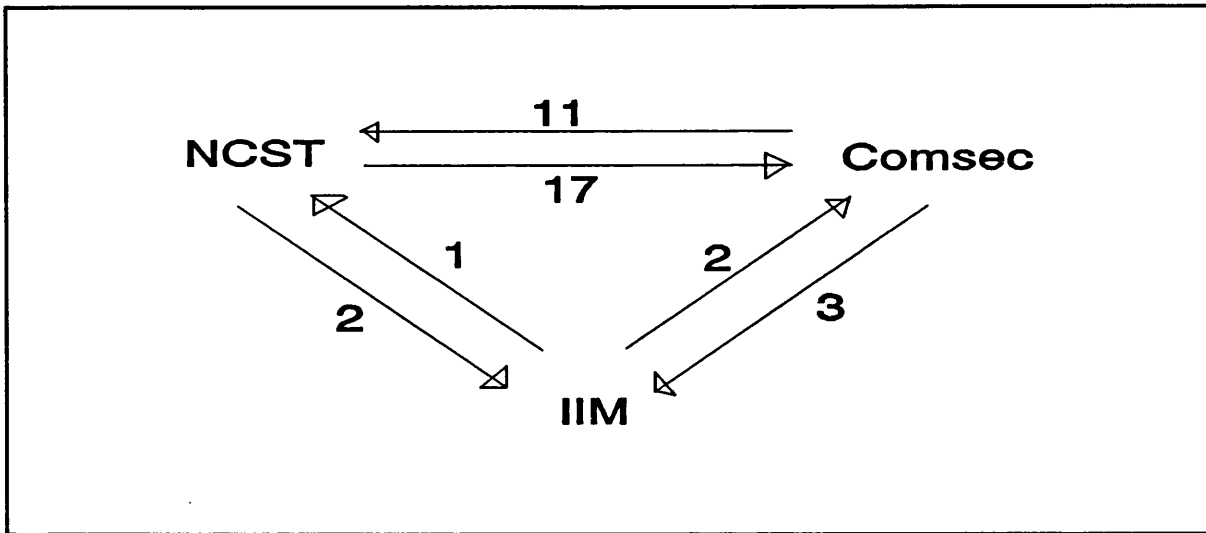


Figure 1: COMNET-IT Workshop discussion

Bilateral linkages

It appears from the data that much of the communication among actors involved bilateral discussion. The main actor reported on a certain activity to the rest of the steering group members. He then received individual questions or comments from the other members in response. This was particularly apparent in the discussions on the agenda item, GOVERNMENT. The actor responsible for the GOVERNMENT project at the time, Comsec, spoke 34 times. The only actor to respond on that topic was NCST. This stratification of the network was further reinforced when the discussion moved on to the agenda item, *The Starter Pack*. The main actor for this topic NCST, spoke 12 times and Comsec spoke 12 times as well on this topic. Similarly, when the agenda item, *Newsletter*, was being discussed, IIM the actor responsible for this activity spoke 6 times. The only actor who contributed to this discussion while IIM was reporting, was Comsec who spoke 10 times, almost twice as much as IIM.

This suggests that the majority of linkages were bilateral and that the basic structure of the network is stratified as a result of the prominence relations. Above this basic structure, there appears to be a temporary, changing structure composed of sets of relations that change according to the activity being discussed and the level of progress being reported by the actor responsible for it. These temporary structures appear to exist

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in conjunction with the basic structure and may have even emerged from the basic structure. These structures merit further investigation and are considered in the following sections.

Effect of external linkages

Further stratification of the basic network structure occurred when there was obvious control over information on access to resources and particularly when this control involved linkages to another network. When the topic being discussed was the ICGITD, a network which COMNET-IT administers, stratification of the basic network structure was reinforced by the temporary relations. The pattern of relations took the form of distinct bilateral linkages with Comsec who was reporting on the progress of the ICGITD. This is illustrated in the discussion of the ICGITD in figure 2.

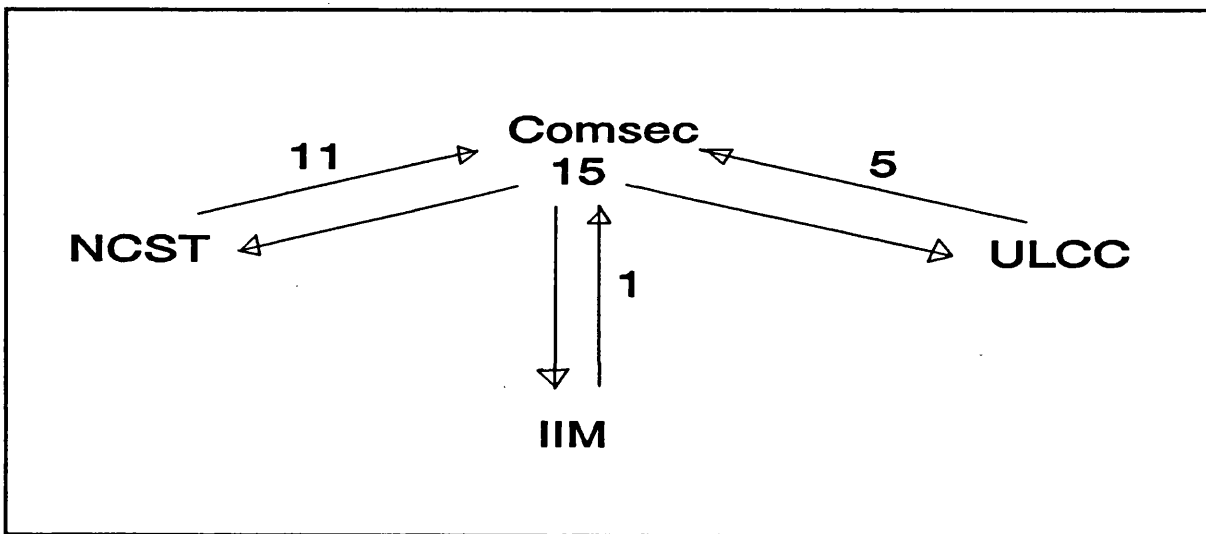


Figure 2: ICGITD Discussion

It is apparent from table 2 that the relations were not directed among the actors but towards and from the one actor. The relations were stratified in that Comsec, the main provider of information and in this instance the link to another network, spoke to all the actors when reporting on his activity while each of the actors spoke to Comsec and not each other. From a prestige perspective, the structure reflects the extent to which actors exercise control over valued resources and authority. Prominent members are the object

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of extensive relations from other members and as is illustrated in figure 2, Comsec has influential links to another more powerful network. As stated in chapter four, this is an area where prestige brings about asymmetry of relations. From a centrality perspective, it appears that the network is also highly stratified with the central actor being the main provider of information. The above structure (figure 2) suggests that the roles occupied by the actors relate to acquiring and/or providing information, resources and contacts rather than on discussions relating to particular issues. There appears to be the need for greater participation in the mechanics of running COMNET-IT as the structure of the network appears to evolve around central actors when they provide information on an activity and/or external contacts.

This informs a more general viewpoint. The COMNET-IT network appears to be driven by activities which rely on each of the steering group members and their respective task forces. The view that the structure of the network changes every time an agenda item changes, suggests a fluid structure driven by centrality relations. The structure of the network is particularly distinct when the subject of the discussion relates to access to information, and resources from outside the network. It appears that prestige relations are associated with structurally equivalent roles which remain despite changes in the people occupying them. This demonstrates that prestige relations comprise the basic, formal structure of this network. Further evidence to support this view is provided by the following analysis of a different type of prestige relation.

Role of expertise

Almost all the members of COMNET-IT exercise control over valued resources and authority, but only two members are the object of extensive relations in which funding issues are communicated. Comsec bears the authority of the Commonwealth Secretariat while NCST who also heads two organisations (one national and another international) has access to a very wide range of valued resources and authority structures. The relations between these two actors had become very visible on the electronic social space particularly when the discussion was about seeking funds, raising funds and even providing funds for certain activities. This asymmetry of relations was however altered

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by the influence exercised by ULCC. The only part of the first steering group meeting in which Comsec did not appear to be dominating the discussion was during the agenda item pertaining to the Commonwealth section in the X500 directory. The actor whose task force was responsible for this activity, ULCC, spoke more than Comsec and NCST put together. This is illustrated in figure 3:

Unlike the other actors on the steering group, ULCC had some pertinent information

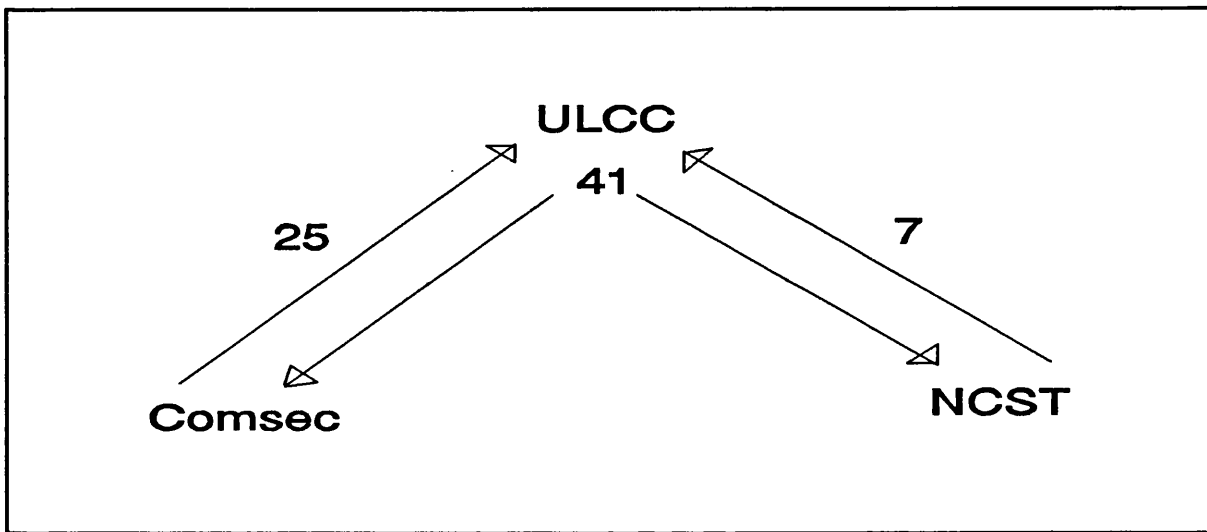


Figure 3: X500 Discussion

to share and was able to generate sufficient discussion with respect to his activity. Another point worth noting is that ULCC was also the only member of the steering group who was not involved in raising, seeking or providing funds. ULCC's influence was associated with his expertise and the fact that his task force could carry out an activity without additional funding. This is not to say the actor was indispensable, but the expertise and the technical resources associated with that role were necessary for COMNET-IT to function.

Comparative analysis

Given the basic structure of communication in the first steering group meeting and the patterns of relations that had emerged, it is worth finding out how these patterns change through time. The specific portions relating to the agenda item, the *COMNET-IT*

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Workshop, were taken from all three meetings and analyzed in terms of the relations that developed. Portions of the transcripts containing this agenda item were compared to illustrate the changing patterns as they took place. In the portion relating to the Workshop of the first steering group meeting, there was little communication on the content of the programme and its administration, but there was more on coordinating the efforts of the two task forces that were involved. The discussion was somewhat general on this topic as illustrated in table 10.

<i>IIM</i>	<i>(') Yes Can we discuss dates for NCST's program so that we can carry an</i>
<i>IIM</i>	<i>(') announcement in Oct news letter.</i>
<i>NCST</i>	<i>(') we can discuss a possible date</i>
<i>Comsec</i>	<i>(') I hope that NCST can firm this up with M. during the next week or</i>
<i>Comsec</i>	<i>(') so</i>
<i>NCST</i>	<i>(') good. i can do that</i>
<i>Comsec</i>	<i>(') The proposal looks very good - I know that M. is keen that it is held</i>
<i>Comsec</i>	<i>(') under the banner of ICCC and COMNET</i>
<i>NCST</i>	<i>(') do you have any comment about the timing, Comsec ?</i>
<i>IIM</i>	<i>(') Will participants have to be sponsored through COMSEC POC's because that</i>
<i>IIM</i>	<i>(') takes a lot of time.</i>
<i>Comsec</i>	<i>(') not really - there are not other events which it needs to tie in with</i>
<i>NCST</i>	<i>(') Comsec, is it possible to get a hard copy of this later, so I don't need to</i>
<i>NCST</i>	<i>(') take notes ?</i>
<i>Comsec</i>	<i>(') tightly - so the main determinant should be the suitability for the</i>
<i>Comsec</i>	<i>(') institutions and toe maximum recruitment of participants</i>

Table 10: Portion of meeting 1

In the second steering group meeting, there appeared to be some progress on the Workshop as the development and piloting of the starter pack were discussed. In order to develop the starter pack, NCST had to coordinate his task force's activities with the African/Management Development task force (administered by the coordinator and

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Comsec). The discussion became more technical with respect to the development of the starter pack and specific with respect to what was expected. A small portion of this discussion is illustrated in table 11 in order to give a flavour for the tone of the conversation.

<i>Comsec</i>	<i>(') next item</i>
<i>Coordinator</i>	<i>(') COMNET-IT workshop</i>
<i>Coordinator</i>	<i>(') over</i>
<i>Comsec</i>	<i>(') The COMNET-IT workshop planned for next March</i>
<i>Comsec</i>	<i>(') NCST - we are waiting to get an estimated cost - any progress?</i>
<i>Comsec</i>	<i>(') over</i>
<i>NCST</i>	<i>(') yes. I have two emails ready to send you. one contains</i>
<i>NCST</i>	<i>(') airfare information for an 18 participant workshop being</i>
<i>NCST</i>	<i>(') run in banglore at the moment.</i>
<i>NCST</i>	<i>(') the other contains hotel rates from a number of</i>
<i>NCST</i>	<i>(') competitive hotels.</i>
<i>NCST</i>	<i>(') I will send it tonight.</i>
<i>NCST</i>	<i>(') /</i>
<i>NCST</i>	<i>(') together, they give you travel and stay costs /</i>

Table 11: Portion of meeting 2

Unlike the first steering group meeting, the Workshop generated bilateral discussion in the second meeting. NCST had made progress on preliminary preparations of the Workshop and that Comsec was keen to build collaboration among the different task forces with respect to both the programme of the Workshop and more particularly, the appropriate development of the starter pack. Still, as is illustrated in figure 4, the relations were directed to and from NCST and the other actors but not between the other actors.

The third steering group meeting did not prove to be as productive as the second with respect to the Workshop discussions. The main actor for this item, NCST, arrived towards the end of the meeting and left after a short while as he was logging on from an organisation in a different city which did not have a reliable connection. In the

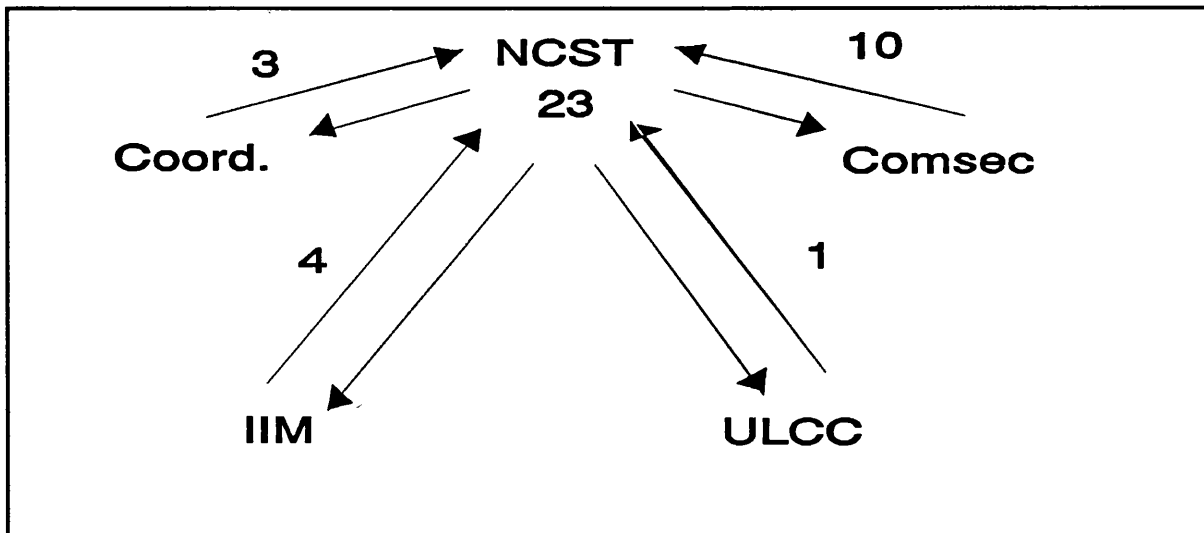


Figure 4: Workshop discussion in meeting 2

portion of the transcript illustrating this discussion (table 12), it is clear that much of the preparations were carried out outside of the meetings. Although the third meeting does not make clear to the other members the extent of the progress, there is nevertheless an element of shared understanding. This portion of the transcript is illustrated in table 12.

NCST	(?) <i>Coordinator, i got the printed brochure/</i>
Coordinator	(?) <i>Are you happy with the programme ?</i>
Coordinator	(?) <i>We are trying to get MJ to arrive</i>
Coordinator	(?) <i>a few days before to help work on the 'how to join the</i>
Coordinator	(?) <i>network ' pack</i>
Coordinator	(?) <i>over</i>
NCST	(?) <i>I have seen the programme.</i>
NCST	(?) <i>broadly the programme with two way parallelism is fine</i>
NCST	(?) <i>exactly how many sessions will be common and how many</i>
NCST	(?) <i>without parallelism will need to be worked out. we will do that and send</i>
NCST	(?) <i>you</i>

Table 12: Portion of meeting 3

Like the second meeting, the conversation with respect to the Workshop in the third meeting was bilateral. This involved information exchange and confirmation of action between the main actor in this activity, NCST, and the coordinator (Comsec had to leave before the end). As illustrated in figure 5, the number of times the coordinator spoke on

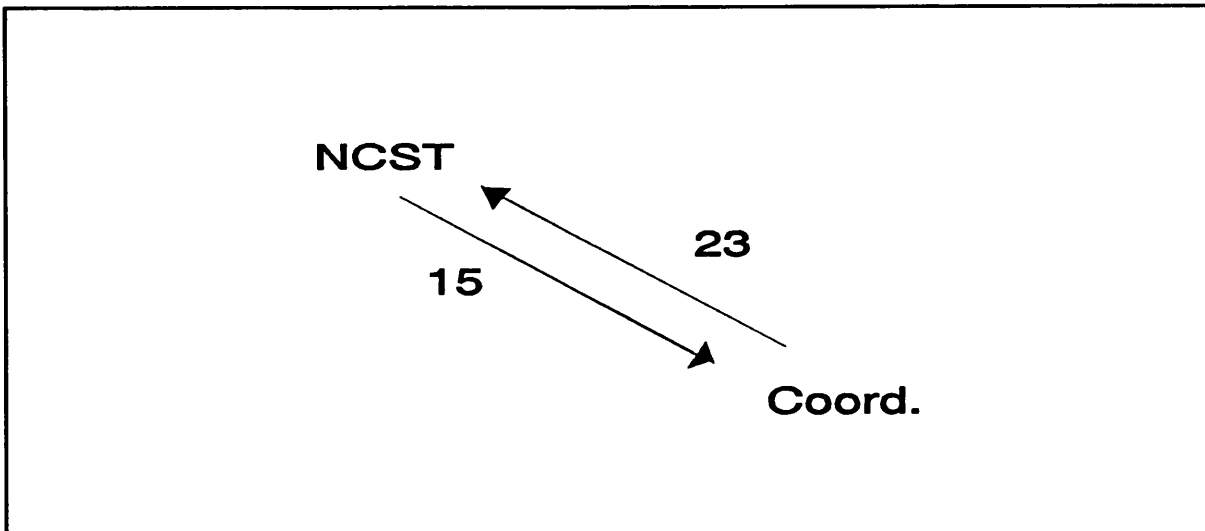


Figure 5: Workshop discussion in meeting 3

the subject is greater than the number of times NCST spoke. This is similar to the relations exhibited by Comsec in the analysis of the first meeting in which he spoke more than the principal actor reporting on an activity. In the absence of Comsec, Coordinator had the responsibility of chairing the meeting and thus exhibited relations similar to those of Comsec. In view of this, it can be said that the centrality relations exhibited by Comsec are structurally equivalent to those of the coordinator.

Comparisons and Substantiation of Emerging Network Characteristics

The analysis thus far has shown how the patterns of behaviour relate to the network structures. It has been shown that while the behaviours displayed by the actors indicate a variety of information exchange behaviours, the basic network structure is in fact very stratified. Above this, a temporary structure has been identified which changes according to a changing central actor. There is little or no disorder in the relations, because the prominent actors are effective in directing relations (centrality) and responding to relations (prestige). Judging from the patterns of behaviour that shape the way in which COMNET-IT functions, it might be said that a coherent identity has emerged as a result of social interaction made possible by electronic communications. This identity is characterised by a network of relations, and the sharing of information and expertise in which different types of technologies support a distributed work process. In addition, the

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organisational characteristics of COMNET-IT, and its associational features need to be considered when attempting to highlight the key features of a network such as this. In the following sections, emerging network characteristics are explored in the context of other initiatives using the layers of networking to substantiate the findings presented thus far.

Technological Considerations

While the technology is instrumental in enabling the steering group members to meet on a somewhat regular basis, it does not entirely support communication among the members. A primary factor affecting the use of electronic communications for meetings, are the lack of 'turn yielding cues' (these are described in chapter one). These cues are often taken for granted in face to face communication, but on the steering group meetings these are still in the process of being developed. The meetings analyzed in this chapter have been very much concerned with establishing rules and procedures. For example, the steering group members established a protocol by which speakers had to indicate that they had completed their comment by typing 'over' or '/' on the screen and remained consistent in using this protocol.

Technical constraints

The talk facility usually did not allow a person's input at a point in time to be displayed as a single paragraph. Instead, only a line at a time could be entered. This meant that while a person was still 'talking' others could easily interrupt as members on slow connections did not see comments on the screen at the same time as they were entered. The result was a very confused looking screen with many stray looking comments that were often linked to more than one conversation. To add to this difficulty, there were no tools available in this technology to assist in moderating a discussion. Although there was a well defined agenda for every meeting, the task of chairing a discussion required a firm hand to keep the conversation structured and well balanced. Conforming to the points listed on the agenda for each meeting enabled a certain amount of structure to be maintained in the discussion even if this was at the cost of thwarting creative debate. For those members who had to log on using dial-up connections, navigating through the

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menus was difficult. Often the users on dial-up links got disconnected every time there was an aberration in the telephone line.

COMNET-IT is not alone with these technical problems. Hiltz and Turoff (1993) describe their Electronic Information Exchange System (EIES) which provides computer conferencing and email services. They elaborate on how EIES had problems with the central host (in 1988) which led to slow response or busy signals. This made the use of the system difficult when it was being introduced to students. In recent years, public domain Internet services appear to have become a very popular means of conferencing. Unlike the COMNET-IT Notice Board software, World Wide Web (WWW) and USENET require software and equipment that is much more expensive to set up and support. The WWW and USENET provide access to a wide range of users and services whereas the COMNET-IT Notice Board is a private system directed at satisfying a specific set of users. While public domain Internet services are in a different league than the COMNET-IT Notice Board, it is possible to compare COMNET-IT with the WWW discussion services in that they enable a group of geographically individuals to communicate with each other.

Adapting to constraints

From the experience of the COMNET-IT talk facility it is apparent that at first, not surprisingly, the process of communication was directed at learning how to use the technology and more importantly how to get around the numerous difficulties that it presented. For example, the participants had to get accustomed to the environment of the software; in particular, how to use the basic commands, entertain themselves with the more advanced commands and then communicate with each other using these commands. Once the users had come to terms with the numerous bugs and connectivity problems in the technology, they had to find out how to communicate with each other in a way that did not waste time (as they had spent a great deal of time trying to get accustomed to the system) without being insensitive to the accepted norms of good behaviour. This was in a sense a more complicated hurdle to overcome especially as the points of discussion could become highly charged with sensitive issues. Needless to say,

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the type of strategic negotiations that have traditionally been made over a glass of wine at a reception, cannot be made on a simple talk facility.

Work Processes

In carrying out a work process the analysis in this chapter suggests that the nature of the COMNET-IT steering group evolved around what was realistically possible to achieve given the circumstances, level of resources and the available technology. The work process in COMNET-IT appears to be *distributive*¹³ in that data is disseminated selectively to the members of the steering group and relevant external contacts. In COMNET-IT the distribution of information in the form of project documents, publications and email messages takes place among the task forces but to varying degrees. This is also illustrated in the behaviours of the more central actors who distribute most information and exhibit behaviours of information providing more than do the less active ones. There is also *generation*¹⁴ of information which is especially apparent in certain prestige relations that arise due to the expertise of certain members. Together, these relations enable work to be done.

Effect of group support

While the electronic steering group meetings provided a structure for work, they were not sufficient in inducing further commitment to projects beyond the activities that were being carried out by the task force leaders. In order to make sense of this finding, it is worth comparing the COMNET-IT meetings with the use of CMC technology to support the work process. In their studies of CMC meetings, Hiltz and Turoff (1993) found that more opinions were given on the electronic media than in face to face communication. They found that participants were more inclined to agree and disagree on specific topics in face to face communication than in computer mediated communication. However,

¹³ This corresponds to Rosenblatt's (1961) concept of a *distributive* node which may selectively disseminate information to some parts of the network (active) or passively disperse information to all parts of the network.

¹⁴ *Generation* on a network means that information from a given combination or intensity of inputs is produced (Rosenblatt, 1961).

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there appeared to be more general antagonism and solidarity generated in computer mediated communication. This suggests that computer mediated communication gives rise to a different type of interaction than more traditional forms of communication.

Although the results in this analysis were not generated by laboratory experiments, it may be useful to compare these with the work of McLeod and Liker (1992). In their work on the need for structuring electronic meeting systems, McLeod and Liker (1992) performed a series of controlled laboratory experiments which demonstrated that manually supported groups are more suitable for the accomplishment of task orientated behaviour. Given that the COMNET-IT steering group meetings were not very successful at defining outcomes for any of the activities discussed in the meetings, the results of this analysis have been consistent with the laboratory experiments of McLeod and Liker (1992).

Adaptation and learning

And yet, in the laboratory experiments carried out by Chidambaram and Bostrom (1993) on GDSS use by students, the key variables investigated were the number of alternatives generated and the quality of decisions made. The results of the first meeting showed that the number of alternatives generated were more from GDSS meetings than in manually supported meetings but the quality of decisions was better on the manually supported meetings. Three meetings later, the number of alternatives generated increased and better quality of decisions were reported on the GDSS meetings than in the manually supported ones. As these results derive from an artificial setting, it cannot be assumed that real life situations will be similar. For the particular situation described by Chidambaram and Bostrom, it can be deduced that the students were learning how to use the technology. In view of this, the value of the above experiments are in that they have illustrated learning processes in which the technology is adapted to suit a work process.

Although the COMNET-IT meetings are not laboratory experiments, the above studies provide an indication of the way in which the technology is adapted for the work process. Contrary to what the author expected to find, the number of problems solved and

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decisions made was remarkably low. This may be attributed to the fact that the technology was not conducive to generating effective discussion and it was difficult to follow a conversation or even moderate a discussion using the tools available on the bulletin board. In terms of structuration theory, the group was in the process of *signification* or using embedded knowledge of concepts and procedures in order to communicate on the electronic medium. It appears that members of the COMNET-IT group meetings were still in the process of learning how to use the technology and adapt it to suit their way of working.

Building consensus and generating discussion

Still, working in this way appears to provide COMNET-IT with a mechanism for building consensus and generating discussion on significant issues. Groupware technology has been used as a mechanism for building consensus and generating discussion by de Vreede and Sol (1994) for combating organised crime by the Amsterdam police force. It was successful in bringing about greater communication among the different police departments. Although the type of groupware used in the police force is unlike the COMNET-IT Notice Board, (a same place same time face to face facility) it is a useful comparison as it not a laboratory experiment and it does reflect the potential applicability of electronic communication tools for coordinating a group of varied activities. In contrast to the COMNET-IT meetings, the use of groupware in the Amsterdam police force was part of a change management process which required specific problem solving mechanisms to be instituted as part of an action research strategy. While COMNET-IT has not developed as a direct response to a problem situation, it has emerged as a means of working among a geographically dispersed group of people who represent a diverse set of expertise.

Organisation

The nature of COMNET-IT is rather different than that professed by the popular management literature (Drucker 1988, Charan 1991, Bradley *et al.* 1993). The activities of COMNET-IT depend upon the initiative and autonomy of its members. If a task force leader is able to successfully carry out an activity, he can to a certain extent, expect the

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collaboration and support of another task force leader. However, the analysis of network structure through time in this chapter suggests that there are regularly occurring features that enable certain structures to persist despite changes in the people occupying the given roles. The evidence suggests that there are some ongoing connections on the COMNET-IT network that *generate* and *transmit* information and resources to the individuals and organisations involved in COMNET-IT¹⁵. In particular, the analysis presents a basic structure of asymmetrical hierarchical relations which involve a prominent leader who allocates responsibilities and resources to the other members.

Features of a network organisation

From the above interpretation of COMNET-IT's organisational features, some features of a 'network organisation' become apparent. While there is no generally accepted example of a network organisation, Ram Charan (1991) provides the case of Conrail which he describes as a network. Conrail went through a change process in which it was reconstructed into task forces or teams responsible for solving real problems such as reducing the work force and evaluating performance. The result was a consolidation of Conrail's activities and greater collaboration among different functional areas. The team building generated greater commitment towards the company's performance.

While both COMNET-IT and Conrail incorporate teams, they differ in the ways in which they function. COMNET-IT functions as a coordinating mechanism for a group of activities that are implemented in a number of different institutions and countries; in this respect, teamwork in COMNET-IT is an ongoing process necessary to accomplish its varied activities. In contrast, teams were used in Conrail as part of a change process to make the company more flexible and able to provide better rail road services. Once this change process was achieved and the behaviour of the employees modified, the teams were disbanded. In addressing the organisational issues in COMNET-IT, it is important to be aware of this distinction between the more popular notion of the network

¹⁵ In Rosenblatt's (1961) terms, a given connection remains through time or may be variable in that a given connection changes at each point in time (*transmission*) and/or information is selectively transformed according to certain predefined criteria (*generation*).

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organisation (Conrail) and the network form of COMNET-IT.

Coordinating mechanisms

In its simplest form, COMNET-IT is a mechanism for coordinating activities and yet it comprises of and is affected by a complex set of relations. At the same time, an activity such as GOVERNMENT, with no single task force leader to see it through, gains considerable impetus just because it has the support of a set of powerful and well-placed people who seek to gain from being part of a particular COMNET-IT initiative. It is apparent that this emerging network form is composed of little in terms of 'organisational structure', but is laden with social processes and complex interpersonal relations that work together to achieve joint objectives.

It can be seen from the patterns of relations analyzed in this chapter that roles of prominence have emerged on the network that allude to structures of hierarchy and centrality. It is apparent that in order to accomplish a task or carry out an activity, there is the need for mechanisms that confer rights and responsibilities to actors involved in the work process. In COMNET-IT mechanisms that confer rights and responsibilities are in the organisational sense, informal, but in terms of social network analysis, these are principal features of the network structure. Because of its centrality, the coordinating centre is able to administer activities and manage collaboration among the task forces. The prestige relations on the steering group meetings, in particular, the leadership of the chairperson, has a strong coordinating affect. In view of this, COMNET-IT can be seen as possessing a very fluid, organic structure capable of easily readjusting itself to new opportunities.

Association

Perhaps the best way of describing COMNET-IT is as an association of people and organisations working together on joint initiatives. The structure of COMNET-IT appears to be unique in that it is composed of a distinct set of activities. It is an association which resembles a consortium of builders or a group of software companies that pool their resources when working together on certain development projects. It is often the case,

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that once the strategic plans of action have been formulated by the management of these companies, it is left to the specialised staff from the different companies, in different geographical locations to work together to implement the project. It is not unusual for such an arrangement to be supported by electronic communications technology. Sproull and Kiesler (1991) report that Hewlett-Packard's human-factors engineers who are scattered around the world, have electronic conferences in which they frequently and routinely discuss professional and company issues.

Use of and access to knowledge and expertise

The case of COMNET-IT, suggests that knowledge and expertise contained in the network enables the network to associate incoming knowledge and information with what is already contained within it. The existence of *association*¹⁶ on a network is characteristic of its ability to learn and continue to accumulate information. In COMNET-IT knowledge and experience are stored in the various individuals, organisations and groups of organisations that are connected to COMNET-IT (ie the X500 consortium). Association in COMNET-IT, refers to the ability of actors to draw upon the relevant knowledge and experience of its related components as well as upon the body of general knowledge available to society. Behaviours of problem statement, requesting action, information seeking, and seeking funds exhibited on the steering group meetings illustrate COMNET-IT's associative properties. The expertise and knowledge contained within each of the task forces enables COMNET-IT to associate new skill and expertise with its own pool of experts. For example, the development of the starter pack was associated with expertise contained within the institutions connected to COMNET-IT and with new developments in low cost electronic networking in Africa.

Spawning new networks

COMNET-IT's ability to spawn new networks may be characterised by the existence of

¹⁶ In Rosenblatt's (1961) terms, *association* refers to when some of the actors on the network are able to compare each incoming piece of information with a previous piece of information stored within an actor (individual or organisation). The existence of stores of information and the ability to access these through the network is the main characteristic of association.

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*sensory*¹⁷ capabilities. In COMNET-IT the existence of sensory actors is not readily identifiable but the existence of this capability is apparent in behaviours of statement of solution, confirming action, seeking consensus, making a decision, volunteering assistance and raising and providing funds. In these terms, the sensory capabilities of COMNET-IT depend upon the nature of its associations and the extent to which it is in touch with environmental conditions, particularly legal factors such as the regulation of networking in some African countries. The COMNET-IT discussions did not include societal factors, but had a great deal of external linkages that may have contributed towards fostering the alliances required for spawning new networks.

There is a sense that network technology enables new networks to be spawned. Sproull and Kiesler (1991), report on a field experiment in which two task forces were formed in a large utility firm, each assigned to analyze employee retirement. Both groups contained forty members, half of whom were retired and the other half employed. The only difference between the two groups was that one worked on networked computer facilities and the other did not. Both task forces created subcommittees, but the electronically supported group created more of them and assigned people to more than one subcommittee. The electronically supported group organised its subcommittees into a complex, overlapping matrix structure and added new subcommittees during the course of its work; it continued meeting even after its official one-year life span had ended. This had not been the case for the unsupported group.

Mobilising resources and collective action

In considering COMNET-IT in terms of associations and the way in which these are sustained, it is necessary to consider task forces that carry out activities, interactions that take place between these task forces and certain sentiments or relations among the task force leaders. The task force leaders have access to the resources and authority structures of their respective institutions and the networks to which they belong. This makes them

¹⁷ *Sensory* components of a network respond to stimuli that are external to the network. The existence of sensory capabilities on a network is an indication of its ability to survive in the wake of forces that are external to the network (Rosenblatt 1961).

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capable of allocating people and resources to accomplish their COMNET-IT activities. This suggests that an association possesses mechanisms for allocating resources and in particular, is able to mobilise collective action.

Summary and Conclusions

In this chapter, an analysis of linkages in COMNET-IT was presented and its network properties extracted. An electronic social space was investigated using the theoretical tools from social network analysis while at the same time drawing upon research in group decision support systems. The theoretical tools from social network analysis were used to provide insight into the structure of the network. By considering behaviour to analyze linkages it was possible to obtain an understanding of the dynamic properties of the network. An analysis of the data generated from the transcripts of the steering group meetings was carried out using social network analysis, and the behaviour of the actors and structure in patterns of relations was ascertained. An analysis of this data revealed that there was a basic network structure which existed on the strength of prestige relations and there was a temporary structure which changed every time centrality relations changed. It was found that the forces that drove this network form were information, expertise and external contacts. The ability to spawn new networks, access resources of different organisations and mobilise collective action were its distinct characteristics.

More general conclusions derived from this analysis related to properties of networks. The behaviours found in the electronic steering group meetings were distilled into more general phenomena relating to the network's ability to transmit data/information on a passive, though regular basis, selectively distribute data/information and generate data/information. Slightly more sophisticated is a network's ability to associate new information with that already stored within it, in other words, its ability to learn. A network also has the ability to respond to changing circumstances. In conclusion, this research suggests that networks may not be tangible or have definite structures, but they do have certain very recognisable characteristics.

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Nothing has changed and yet everything exists in a different way

Sartre

Chapter Seven:
Insights into Networking

Chapter Seven: Conclusions and Insights into Networking

Introduction

This chapter begins by summarising the arguments presented in this dissertation, the contributions made and facts uncovered. Features of networking derived from the investigation of the electronic social space are described in terms of the experiential knowledge gained from an in-depth understanding of the case study and an empirical inquiry from which certain generalisable conclusions have been arrived at. In this chapter the properties of networks are recapitulated and synthesised, using the findings of this research, into a set of practical insights relating to the use of electronic communications technology to support networking processes. These contributions are discussed in terms of processes of adaptation in which the use of electronic communications technology, the networked work environment and social processes are considered.

Following a description and synthesis of the findings, the approach of this research is evaluated in the light of the contributions and facts uncovered. As the purpose of this research is to guide the researcher in capturing the richness of observable reality and to draw inferences into the structure and function of a network, the approach of this research is evaluated in terms of the extent to which it has achieved this purpose. The approach of levels is compared with other levelled approaches to distinguish its usefulness and its drawbacks. The use of structuration theory and social network analysis is evaluated separately in terms of the extent to which each theory was found to be appropriate for this research and the extent to which they enabled meaningful conclusions to be drawn.

Finally, suggestions for future research are made and possible areas in which this research may be useful are suggested. In particular, an opportunity is identified for the use of systems thinking as a means of enabling a better understanding of the broader contextual issues pertaining to networking and to allow the use of qualitative data analysis techniques within an interpretivist research strategy. In doing this, reflections are made as to what might have been done differently.

Summary of the Dissertation

This dissertation set out to investigate the network phenomenon by considering human networks in relation to factors that influence the use of technology and affect the nature of the work process. Current literature on the use of the network concept was found to be very varied. These different views of the network concept were used to inform the definition of an approach of levels of networking depicting five distinct perspectives. This approach of levels was then used as part of an interpretivist research strategy to enable the researcher to make sense of the networking phenomena observed in the case studied. While the case study was not used in this research to validate a theory or hypothesis, representativeness and rigor were designed into the research strategy to enable generalisations to be arrived at. Through the use of a combination of theories to analyze findings from the case study, it was possible to highlight certain key features of networks that may apply to other contexts.

Organisational theory and management practise were seen to be insufficient in addressing loosely coordinated, geographically dispersed, multi-organisational work processes. The network technology supporting this work environment had to be considered. Existing research in information systems expressed the need take into account social forces in order to develop more appropriate information systems, but was still in the process of coming to terms with its more positivist, scientific roots. Because the work processes in COMNET-IT were endowed with features of traditional task structures, it was necessary to consider organisational perspectives and identify areas that could be modified in a way that would assist exploration of the networking phenomenon.

Structuration theory was set out as the basis for epistemology, as a sensitising device, and was presented as a means of exploring social structures. Being a meta-theory, structuration theory did not provide support for analyzing data. In order to analyze data on patterns of behaviour to obtain some understanding of network structure, a set of practical concepts from social network analysis were used. Using social network analysis within an interpretivist research strategy provided a means of developing an understanding of network structure that progressed beyond the traditional organisational

paradigm and the positivist underpinnings of information systems research.

A description of the COMNET-IT case study, was provided in both depth and breadth. A longitudinal perspective enabled the development of COMNET-IT to be described through a description of the evolution of COMNET-IT's activities and related networking initiatives. The result is a detailed story, a phenomenological account, of the different aspects of networking presented as a single case study involving many networks and networking processes. It becomes apparent from this description that there are many different types of networks, and processes of networking and they do not occur in isolation. Thus the COMNET-IT network coordinated GOVERNET which was in turn dependent upon other networks in Africa to support networking among a set of management development institutions.

The data was interpreted using the approach of levels. This was used to compare aspects of COMNET-IT with other initiatives and to substantiate findings from the analysis. The analysis of the empirical data uncovered aspects of networking as they occurred in the electronic group meetings. In particular, the analysis revealed an understanding of network structure and, using the levels, properties of networks were identified. These and other facts and insights uncovered are described in the following section.

Facts Uncovered and Contributions

The COMNET-IT network certainly did not fit the management or organisational theorists' view of a network organisation. It did however possess certain features of an organisation in that there were certain ongoing mechanisms for coordination, decision making, information processing, and allocating responsibilities and resources. From an analysis of behaviour and network structure, it became clear that the network structure of COMNET-IT was capable of coordination, information processing, and allocating people and resources. Features of association were identified as professional and institutional linkages, in forging alliances, and through building partnerships and mobilising resources. It was found from the analysis that there were extensive linkages with people and networks outside of COMNET-IT from which resources could be drawn

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for its activities. As an association, this network also had the ability to spawn new networks. At the societal level, the network was concerned with public administration reform, which required concerted effort amongst governments and international agencies, and an understanding that this responsibility had to be shared. Issues identified at the societal level related to the use of information technology amongst senior civil servants and the likelihood of abuses of power. However, the transcripts of the electronic meetings did not show any behaviours at the societal level of networking. This suggests that societal issues were of little concern to the steering group members and hence the way in which COMNET-IT functioned.

An electronic social space was investigated in which a set of norms and perspectives developed. These were explored in terms of behaviours (processes) and patterns of relations (structures). While Harasim (1993) refers to the use of computer networks for human communication as a *social space*, the notion of the creation of social structure on an electronic communication medium in which actors meet both synchronously and asynchronously from different geographical locations, the *electronic social space*, is unique to this dissertation. Using the synchronous conferencing facility required moderation of discussions; equally the asynchronous discussions required careful structuring. The effect of electronic group support in facilitating the sharing of skill and expertise in a geographically distributed work process involved adaptation and learning how to use the technology. In this, the work processes evolved as a mechanism for building consensus, and generating discussion to bring together a group of varied tasks and activities. The electronically supported work process also became a forum for consultation and collaboration.

In considering behaviours of human actors on the electronic group meetings, the analysis uncovered data relating to the type and level of linkages, properties and content of the linkages in relation to the actors, and the type of influence actors exercised. A number of multiplex linkages emerged on the electronic social space which indicated that work oriented behaviour relating to the exchange of information and resources predominated. The network appeared to be structured in two ways. The prestige relations comprised a

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structure that persisted despite changes in the people occupying certain positions. This was the stable structure. Above this basic structure was a fluid, changing set of centrality relations. In all this, the role of expertise was interesting. The prestige relations exhibited by virtue of expertise appeared to change the basic structure of the network in which the chairperson dominated the discussions. In the comparative analysis, it was interesting to note that although the first meeting generated multilateral discussions on the COMNET-IT Workshop, the subsequent two meetings were increasingly bilateral.

Taking into consideration the insights gained thus far from an analysis of the steering group meetings, it was possible to generate some general insights into the nature of networking. It was found that categorising behaviours enabled certain properties of networking to be explored. The research drew upon an established view of network structure to identify these properties. According to the theory of neurodynamics, the state of a network is its structural representation and in order to be dynamic, it must comprise of some active nodes (Rosenblatt 1961). It suggests that networks have certain properties that relate to its ability to 1) transmit data in a network, 2) distribute this data, 3) generate new data, 4) associate new data with that stored in the network and 5) have the ability to perceive changes in environmental conditions. With these properties in mind, the insights gained into network structure were then summarised in terms of the levels of networking.

A network property supported by the technology was distribution of information through computer mediated meetings, structuring discussions, communicating on email and asynchronous computer conferencing. Within the distributed work process enabled by the technology, the more central actors exhibited greater frequency of information exchange behaviours. In particular, the work process was still adapting to a technology which supported the distribution and generation of information. At the organisational level, the linkages among actors were distinguished as ongoing connections that generate and transmit information and resources throughout the network. These properties of network structure were identified in the relations which enabled activities to be administered and collaboration managed (centrality relations), and required leadership to confer rights and

responsibilities (prestige). Two additional properties of networks were distinguished at the associational level. The network's ability to associate new knowledge with what was already contained within the network enabled it to learn. Accumulating stores of information and expertise alone were not sufficient. The network's ability to reposition itself and spawn new networks where appropriate as a result of its sensory capabilities was also identified. It was found that the sensory capabilities of the network were aided by a large number of external linkages.

Synthesis of contributions

The above suggests that the network has some very distinct properties that enable it to possess a very fluid dynamic structure while at the same time maintaining a more stable set of relations. From the above facts uncovered and contributions presented, learning and sharing of information and resources appear to be key to the survival of a network such as COMNET-IT. In this section these contributions are synthesized further into more practical insights into aspects that need to be addressed in order to effectively support network processes when using computer mediated communications technology. In particular, it is necessary to address the types of learning and the ways in which technology may support task accomplishment and decision making by enabling group members to appropriate the available tools. In the following sections, these points are discussed separately in terms of adaptation, and where possible, areas that require support for network processes are highlighted.

Technological adaptation

The analysis presented here suggests that while the electronic social space enabled relations of prominence to come into effect, it did not entirely support decision making in the COMNET-IT steering group. This was largely explored by the observation that the group was still in the process of appropriating the technology to fit its own patterns of communication. In effect the way in which the participants learned to use and become comfortable with the technology was illustrated in the behaviours displayed and the type of prominence relations that emerged. When compared to face to face meetings among COMNET-IT steering group members, the electronic meetings exhibited more consensus.

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Of the agenda items discussed in the face to face and electronic meetings, action was confirmed a number of times on the electronic meetings but action was only proposed on the face to face meetings. This is perhaps due to the nature of the electronic meetings. As the participants typed their comments on the talker, they had visual images of the discussion which they could read a number of times before responding.

The technology also demonstrated a potential for inhibiting the communication process. In particular, with a lack of turn yielding cues (which are available in face to face communications) participants were faced with a rather harsh environment on the electronic medium. This environment gradually became more conducive as the participants learnt how to use the technology and the tools that were available. It was found that in the first stages of computer mediated communication, the group processes were directed at learning how to use the technology and more importantly how to get around the numerous difficulties that it presented. In subsequent stages of group development, the technology became a means for attaining a joint objective or a means of carrying out an activity. At this stage more sophisticated tools for problem solving and decision making were required and had to be learnt. The whole group had to be able to use the technology appropriately for such meetings to be successful. Overall, this process of learning how to use the technology may be referred to as technological adaptation. Support for technological adaptation should be provided through training and learning aids which group members could use to appropriate the technology in a way that suits their ways of interacting and working.

Work adaptation

In the case of the COMNET-IT steering group meetings, the work process was shaped to a large extent by the content of the linkages or type of information exchanged. Processes of task structuring, resource allocation, and the coordination of geographically dispersed but interrelated activities were significant components of the work process. In this, the work process required support in terms of the content of interpersonal communication but also in terms of supporting the leadership function. Moderation of discussions was an important feature, and was necessary to enable the participants to

focus their discussions. In view of this, prominent members required support in their roles as leaders and/or moderators. Centrally prominent members required speedy and efficient information exchange. Faulty connections, bad transmission and a rigid interface could make it difficult for such a member to perform their information providing role. In the case of COMNET-IT, there was ample support for centrality relations that required information exchange capabilities but not for prestige relations.

This process of adaptation to a work environment supported by computer mediated communication, may be referred to as work adaptation. In this research, work adaptation means that there is a process of attaining synergy between behaviours of the participants and the ways of working that they are accustomed to. While certain types of behaviour are enabled by the electronic medium of communication, the changing work process also influences behaviour. Supporting this processes of work adaptation requires a combination of information exchange tools and a means of storing information for access at a later stage.

Social adaptation

The electronic media enabled a social system to manifest itself. The identity of the group took shape in accordance with the social norms that emerged on the electronic social space. In particular, the sets of rules and knowledge that the group members brought with them in their social encounters on the electronic medium amongst other less frequent personal encounters, can be seen in Giddens terms as, *combined human action*. This, he claims, brings about patterns of interaction that then become established as standard practices. An example of standard practise on the electronic social space was that participants made it a point to tell the group when they logged off even though the system automatically makes this known. In the COMNET-IT meetings, certain norms and procedures developed and changed the ways in which work was carried out. This process, of using embedded knowledge of concepts and procedures in order to communicate is identified by Giddens (1984) as being the process of *signification*. Signification was apparent at the stage at which the COMNET-IT steering group meetings and the ICGITD discussions took place. This stage was identifiable in that communication

behaviour was still in its formative stages and mechanisms of communication were in the process of being acquired. In particular, communication etiquette, and norms of good behaviour on the electronic social space were developing.

The group members were in the process of developing a culture of communication on the electronic social space. This research suggests that at the signification stage, the electronic group meetings required a great deal of support. In terms of prominence, this would entail behaviour modification according to the centrality or prestige relations that emerged. For example, if centrality relations predominate on the electronic social space, then group members would require support to perform information exchange behaviours. If however, prestige relations have greater influence on the electronic social space then members should be able to access appropriate information, people or resources from outside the network.

Evaluation of the Research Approach

The use of an interpretivist research strategy to explore the network phenomenon provided a means of extracting the rich detail necessary when considering an area in which research is still in its formative stages. The role of the interpretivist researcher in describing social processes and providing explanations for their behaviour while being part of these social processes enabled a realistic understanding of the situation under investigation. A balance had to be achieved between description and generalisability. The richer the description, the greater the risk of sacrificing generalisability. In order to attain generalisability, rigor and representativeness had to be designed into the research strategy. In order to achieve this balance, the description of the case study was interpreted using an approach of levels and empirical data were analyzed using concepts from social network analysis.

Approach of levels

Using a levels approach to investigate communication relations is in itself not new. A comparison to the levels approach of this research may be made with the levels approach proposed by Contractor and Eisenberg (1990). They developed a model of social

information processing which draws upon Giddens' structuration theory (1984) and Burt's theory of structural action (1983) to address relationships between social structure and the use of electronic communications media. They present a review of the literature on networks and the new media using a model of *Communication Network Participation* which consists of three levels. The first is the *individual* level, in which the size of the network (absolute number of contacts), its connectedness, centrality and range are considered. The second is the *dyadic* level at which the strength (frequency of communication), multiplexity (number of types of relationships), and structural equivalence (the extent to which two members share similar patterns of communication) is considered. At the third level, the *group* is examined in terms of size, density, connectedness and centralisation. Contractor and Eisenberg use this model to draw conclusions about the ways in which individuals and groups use the technology. Like structuration theory, Contractor and Eisenberg's model validates itself using evidence derived from the case examined. It does not provide explanations to account for why people behave in the ways that they do, but uses the evidence provided in the case and other studies to explain the model. However, the approach of levels developed in this research is used to build an understanding of network structures and provide explanations of the ways in which they function. In addition, the levels approach of this research also addresses networks at the organisational, associational and societal levels representing a broader perspective than that of Contractor and Eisenberg (1990).

Studies by Er (1987) and Kerr and Hiltz (1982), address the technology in terms of individuals, groups, organisations and society. They provide insightful reviews of the literature on the impact of computing and information systems (Er 1989), and on an evaluation of computer conferencing systems (Kerr and Hiltz 1982) at each of these levels. The approach of levels developed in this research, goes beyond a literature survey and uses the levels as part of a research strategy. It was initially developed to enable the researcher to interpret the network phenomenon and isolate the salient features of networking from the case study. In the analysis of empirical data on behaviours, this approach of levels was also found to be useful in enabling multiplex linkages to be explored. In addition to being a tool for interpretation and analysis of the data, it also

provided a means of comparing and contrasting the findings of this research with other studies.

While the approach of levels has been a valuable means of guiding the researcher through the interpretation, analysis and comparison of the data, it had to be used with caution. If the researcher had not been informed by her first-hand knowledge of the situation being investigated, and had not taken into consideration the different perspectives of the actors, the approach of levels may have had the effect of rigidly imposing network views on all phenomena.

Structuration theory

In the initial stages of this research, structuration theory was seductive. Being a meta-theory it formed the basis of epistemology in that it sensitised the researcher to how she viewed social processes. Evidence from the transcripts of the electronic group meetings did support certain premises of structuration theory. For example, it was possible to identify the process of signification in the electronic group meetings. However, the use of structuration theory did not tell the researcher anything beyond what was observed. It provided no explanations to account for how the social processes observed affect networking. The concept of duality did not provide any additional insight into the behaviour of human actors in relation to the creation of social structure. It would perhaps have been, upon reflection, more appropriate to have not considered structuration theory in the detail presented in chapter four. In retrospect, its usefulness for this research was only marginal. A majority of the findings in this research were arrived at with the aid of the levels approach and social network analysis.

Social network analysis

The use of social network analysis concepts to analyze the structure of human networks in terms of the behaviour of human actors, prove to be much more useful. The previous chapter presented an analysis of network structure and shed a different light on existing knowledge of network structure and the way in which it operates. The use of the positional approach enabled the basic structure to be recognised. The relational

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approach enabled the shape of the changing temporary structures to be identified. Concepts of prominence were useful for both approaches. With the use of concepts of centrality and prestige, an empirical analysis of behaviours could be carried out and patterns of relations could be uncovered. When considering centrality, it was found that not all relations need involve a single actor. A consideration of prestige relations revealed that a single actor was not necessarily the object of all relations. In terms of Monge and Eisenberg (1987), the analysis of this thesis considered the content and formation of linkages on a computer mediated communication network. This research took the work of Monge and Eisenberg (1987) further in that it provided empirical evidence to describe the type, content, and properties of the linkages identified. In addition, this evidence was considered at the technology, work, organisational and associational levels. With an understanding of the type of prominence relations, it was possible to make assertions as to the type of support required to facilitate interactions on the electronic medium of communication.

Future Directions

The above suggests that research into the network phenomenon may be carried out at any of the above levels of networking. While this research has provided a basis upon which networks may be investigated, the approach of this research may be used in a number of different settings and refined accordingly. An investigation of the use of electronic communications to support network structures in a multi-national organisation would be particularly useful. Investigations of this type would prove to be invaluable in building the empirical basis for such research and in extending theories developed by case studies into more generalisable forms (Smithson *et al.* 1994).

Systems Thinking

Checkland's (1981) systems classes may be extended towards an exploration of networking. These classes can be defined as: natural networks, human activity networks, designed physical networks and designed abstract networks, and might be used to explore the network structures presented in this research further. This research has explored an association in great depth, but there is still the need for further research at the work, and

organisational levels that takes into account distributed work processes. A systems perspective may be of particular assistance in attempting to make sense of networking at the organisational level. According to a systems perspective, an organisation is comprised of an external environmental system and an internal system of mutually interdependent relationships (Checkland 1981, Beishon and Peters 1981). A social system, according to George Homans's (1950) definition, is comprised of activities or tasks which people perform, interactions which occur between people in performing these tasks and sentiments that develop between people. In this sense an organisation may be seen as an open system which is in continual interaction with its environment and achieves dynamic equilibrium while still retaining the capacity for work (Kast and Rozenwieg 1981).

Qualitative data analysis

Within an interpretivist research strategy qualitative data analysis may be seen as a "systemic" approach to understanding interaction of variables in a complex environment (Miles and Huberman 1994). In addition, the use of computer supported quantitative methods to aid qualitative data analysis presents itself as a means of adding power and sensitivity to individual judgement. It facilitates the interpretive researcher in describing patterns in a set of observations, extract meaning and identify causal relations. In this, the issue is one of knowing when it is useful to use computers for qualitative data analysis and when it is difficult or inappropriate.

Further research using quantitative data analysis techniques would be of value when attempting to arrive at generalisations from case study research. This research has explored networks from a behavioural perspective and has presented a means by which quantitative data analysis using computer support may facilitate the interpretation of data and its analysis. Future research could investigate networks using qualitative data analysis techniques or modelling formalisms (as described in Appendix III) within an interpretivist research strategy.

Conclusions

This research has provided a means of investigating networks, and of identifying their characteristics. It has concluded with certain generalisable characteristics of networks and synthesised these into more practical insights into how network processes may be supported. An evaluation of the approach of this research indicates that the five levels of networking prove to be useful in guiding the interpretation of the data. However, upon reflection, the use of structuration theory only enabled the researcher to identify structuration processes in the case studied, but this insight did not support explanation of why actors behave in the ways that they did. At the same time, concepts from social network analysis were invaluable in providing the explanatory power of this research. The concepts that guided the empirical analysis of behaviours enabled generalisations to be made about certain features of networks that may apply to other contexts.

In this research a basis has been produced upon which further studies of the network phenomena may be undertaken. Together with the levels approach, systems classes may be extended to guide an investigation of networks. Future research investigating networks at the work, organisational and associational levels may employ the social network concepts of this research, within a broad interpretive research strategy. This research suggests that there is potential for the use of quantitative data analysis techniques within an interpretivist research strategy when investigating network phenomena.

Knowledge, you see, has no uses without purpose, but purpose is what builds up enclosing walls.

Frank Herbert

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List of Abbreviations

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AAS	African Academy of Sciences
AMTIESA	Association of Management Training Institutes of Eastern and Southern Africa
APC	Association for Progressive Communications
BBS	Bulletin Board System
CIDA	Canadian International Development Agency
CMC	Computer Mediated Communication
COMNET-IT	Commonwealth Network of Information Technology for Development.
COMSEC	Commonwealth Secretariat
CSCW	Computer Supported Cooperative Work
EARN	European Academic Research Network
ESANET	Eastern and Southern African Network
EEC	European Economic Community
EIES	Electronic Information Exchange System
ELCI	Environmental Liaison Centre International
ENDA	Environment et Development du Tiers Monde
ESAMI	Eastern and Southern African Management Institute
FTP	File Transfer Protocol
FAO	Food and Agricultural Organisation of the United Nations
GATT	General Agreement on Information Trade
GOVERNET	Network of Government Institutes
ICCC	International Centre for Computer Communication
ICGITD	Informal Consultative Group of Information

Abbreviations

	Technology for Development
IDD	International Direct Dial
IDM	Institute for Development Management
IDRC	International Development Research Centre
INTERNET	International Network
IFIP WG9.4	International Federation for Information Processing, Working Group 9.4
IGC	Institute for Global Communications
IIM	Indian Institute of Management
IP	Internet Protocol
IPA	Institute for Public Administration, Uganda
IPN	International Public Network
IT	Information Technology
KIM	Kenya Institute of Management
LIPA	Lesotho Institute for Public Administration
MANGO	Microcomputer Assistance for NGOs
MDI	Management Development Institute
MIM	Malawi Institute of Management
MTSD	Management Training and Services Division
NCST	National Centre for Software Technology
NGO	Non-Governmental Organisation
NIPA	National Institute for Public Administration, Zambia
NSFNET	National Science Foundation Network
OECD	Organisation for Economic Cooperation and Development

Abbreviations

PADIS	Pan African Development Information System
PDN	Packet Data Networks
RINAF	Research and Information Network for Africa
RIO	Reseau Informatique de l'ORSTOM
SADAC	Southern African Development Community
SARDC	Southern African Research and Documentation Centre
SIM	Seychelles Institute of Management
SIMPA	Swaziland Institute for Public Administration and Management
SMTP	Simple Mail Transfer Protocols
SWIFT	Society for Worldwide Interbank Financial Transfers
ULCC	University of London Computer Centre
UNECA	United Nations Economic Commission for Africa
UNDP	United Nations Development Programme
USAID	United States Aid for International Development
ZIPAM	Zimbabwe Institute for Public Administration

Appendices

Appendix I

Networks in Africa:

Sources: Rinaf study 1992, Mike Jensen 1991, Electronic Networking in Africa 1992, Hafkin 1992.

AFRIKANET:

Afrikanet was created in order to build a computer network between the African countries and the rest of the world. Conceived at the Centre de Calcul de l'Universite' de Yaounde', Cameroon. This is a packet switched network that is supported by the national Telecommunications agency. The project has two objectives:

- The setting up of a pilot node at the Centre de Calcul de l'Universite' de Yaounde' and eventually the creation of a local network directly connected to that node;
- The organization of a Pan-African meeting to discuss the results of the experiences of other African countries. During this meeting the proposal of an organization (similar to EARN) in charge of the direction of the network was discussed.

The availability of documentation on networks in French West Africa is not very substantial and it is thus difficult to ascertain the extent to which AFRIKANET is functional rather than confined to project documents.

AFRINET:

A project that is to be funded by the US National Science Foundation, the aim of AFRINET project is to link US Universities with the African Academy of Sciences. The result is to be an African Research Information Network project connecting US Universities with the African Academy of Sciences and universities in Kenya, Zimbabwe, Tanzania and Uganda. The project is directed towards developing the network by encapsulating Decnet for X25 networks currently operating in Africa. These public data networks will permit the networking of computers in the selected African countries (Kenya, Zimbabwe) with the largest internal academic regional network. The intended network protocol is based on the CCITT X25 and encapsulates other major protocols, including TCP/IP, SNA/SDLS, Decnet, AppleTalk, Bisync and X3 Pad. This will allow the CSUNET to de-encapsulate Decnet from X25 once received and then re-encapsulate into TCP/IP for interconnection into the Distributed Bestnet network with Gateways into NSFNET and the Supercomputer Centre Network. It is intended that in this project, it will be possible to interconnect VAX Computers at the University of Zimbabwe with those at the African Academy of Sciences in conjunction with

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the University of Kenya in Nairobi.

ARSONET:

An IDRC/CIDA funded project that attempts to link the ARSO secretariat and its member Standards Organizations (all 27 of their offices in Africa) electronically by giving them E-mail and File transfer capabilities. This project is to install and train people in three of these offices in Nairobi and Addis Ababa building on the other IDRC-supported projects involving experimentation with telematics linkages among ARSO members. ARSONET is a CIDA professional development project to link the African Regional Standards Organisations in Addis Ababa Ethiopia, Dakar Senegal, Nairobi Kenya and Cairo Egypt with FIDO networking technology. ARSO has established a node in Nairobi which also connects daily to London. In Addis, users are connecting with PADIS, their host, in Senegal through ENDA and a separate system connecting directly to London will be established in Cairo. It is hoped that ARSO and its associated offices would be able to set up their own internal conference about standards in Africa. Using this they can carry on discussions about any topic regarding their work and share information between all members on line. ARSO aims to use a FrontDoor software which allows the user to operate a local electronic Bulletin Board mirrored to an international FIDO node or gateway.

EARN:

Controlled at the EARN office in Paris, it has links to Cairo University connected via Montpellier (9.6 Kbps leased line), Tunis is connected via Montpellier (X25 Dial up link) and Rabat is connected via Frascati (dial up link) Algiers will be connected through Montpellier. This project links computers installed in various national and international locations in Europe, the Middle East and Africa. At the moment, Algeria, Egypt, Morocco, and Tunis are connected to EARN.

Some physical lines are exclusively used for EARN and paid for by EARN members or groups of members (countries). Other lines are shared with other academic networks providers. On the level of technical service EARN is an application network using the IBM Network Job Entry protocols (NJE). Some higher level services e.g. RFC822 Internet Mail or LISTEA RN are provided above NJE. Services on EARN are as follows:

- Send and receive Electronic mail messages;
- Transfer files or data sets of any type;
- Share computer resources (Remote Job Entry);

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- Exchange interactive messages or have On-line conferences;
- Access remote applications (File servers, data bases, libraries, etc.).

ENDA-ARABE:

This node is based at ENDA Inter Arabe in Tunis, Tunisia. In their capacity as the semi autonomous North African wing of ENDA Tiers Monde, they are the current designated operators of the node. The hardware available for this is a Laplus 6200 AT286 12MHZ Laptop computer with 40MB hard disk and a Telebit Trailblazer PEP/9600/2400/1200 baud modem. The software is a Front Door V 2.02 mailer/editor, Gecho 1.00 mail processor, Redir 1.10, message redirector, MT 3.20 message logger, BNU 1.70 Fossil Driver. In a report by Mike Jensen (1993), Communications Consultant for IDRC, a VGA colour monitor was lost in transit by Air France. A refund has been received and this will be used to buy another monitor. This is essential as the backlighting on the laptop screen is no longer functioning, making the screen illegible. However being exclusively Macintosh users they were not able to work out some of the low level hardware setup features of the system and assumed there was a basic hardware failure with the machine. Unfortunately this was corroborated by other seemingly knowledgeable people. However there was in fact no problem with the equipment which has been operating flawlessly for the last 3 weeks following the consultant's visit. Nevertheless the node is not yet operational for incoming calls because no telephone line is available. Phone lines are relatively reliable and high quality IDD calls are obtainable on a continuous basis. According to the report, the inoperational state of the node meant few problems could be identified. The system software was upgraded to the latest versions in preparation for full operation. The Trailblazer does not do V.32 19200 baud and so maximal cost savings will not be achieved on IDD calls. Currently there is no available backup equipment or technical support unless the node moves to one of the other NGOs (Jensen 1992).

ESANET:

Also with IDRC funding, ESANET is a pilot project to link researchers at universities in Uganda, Tanzania, Zambia, Zimbabwe and Kenya with each other and with researchers around the world by installing E-mail facilities at the computer centres of universities in these countries. ESANET is coordinated by the University of Nairobi Institute of Computer Science. To maximise scarce resources, co-ordination and technological support are being shared with the NGONET Africa project. The Environment Liaison Centre International (ELCI) in Nairobi provides training and expertise in the use of the FIDO software, FrontDoor to ESANET users. Where there is no local NGO host system it has been agreed that NGOs will be able to use the resources of the campus based nodes. Nodes are currently being installed in:

- Kampala - Makerere University - nodename MUKLA,

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- Nairobi - nodename UNICS,
- Dar es Salaam - University of Dar es Salaam/Eastern and Southern African Universities Research Project - nodename ESAURP,
- Lusaka - University of Zambia Computer Centre - nodename UZCC, and
- Harare - University of Harare Computer Centre - nodename UHCC.

Each node runs a suite of FIDO software on an IBM compatible AT, high speed modem (PEP) and dedicated telephone line. Zambia, Kenya and Harare can connect directly to the GreenNet FIDO gateway, while Uganda and Tanzania can only connect via Nairobi because direct dialling facilities outside the PTA (Preferential Trade Agreement) area are not available. Zambia has begun to experiment with direct dialling to London and the other nodes are expected to begin testing connectivity later shortly.

HEALTHNET:

Administered by the ESANET project, HealthNet is supported by SatelLife in Boston Massachusetts. Because of the overlap in the institutions with electronic communications nodes in Africa, the HealthNet project is being administered by the African participants as part of the ESANET project to evaluate alternative data transport methods. The countries involved are: Kenya, Mozambique, Tanzania, Zambia, Uganda and Zimbabwe. HealthNet is operated by a Boston based NGO called SatelLife which was initiated as a project of the International Physicians for the Prevention of Nuclear War (IPPNW). SatelLife have purchased 60% of the capacity on the University of Surrey (UK) built Uosat-F satellite. This will initially be used to exchange health and medical information within the same universities (coincidentally) participating in the ESANET project and via Memorial University in Newfoundland Canada. Memorial is deemed to be an appropriate site because among other things it is the location of Dr Maxwell's House, and it has a research programme in telemedicine. The primary reason for this location is because it is so far north that the satellite passes over it 10 times a day on its polar orbit. It uses a low orbit satellite packet radio with Zambia hosting satellite traffic. Although the current traffic is limited to health related issues, it is entirely up to the individual participating institutions in Africa to obtain clearance from the authorities for a wider interpretation of the health mandate. As far as the funders of the HealthNet project are concerned, this could encompass a much broader range of environmental and social issues. Currently Kenya, Mozambique, Tanzania, Uganda, Zambia and Zimbabwe have been successful in obtaining approval for the installation of the ground station and this was with a specific medically oriented application. Zambia will now be able to host satellite traffic from the other participating countries via direct dial telephone lines with the ESANET FIDO network until other ground stations have been approved. The Zambian approval nevertheless sets a

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precedent for the authorities in the other countries. Also Zambia will now be able to host satellite traffic from the other participating countries via direct dial telephone lines with the ESANET FIDO network until other ground stations have been approved. More recently the Dean of Medical Studies at the University of Makerere in Kampala, Uganda has expressed optimism over approval of their satellite application which has an even broader mandate to include environmental information.

GHASTINET:

An IDRC funded project based at the Centre for Scientific and Industrial Research (CSIR) in Accra, Ghana. This project relies on a 386 personal computer connected by a modem to an international direct dial telephone line. Polls on demand to GreenNet. This 386 personal computer is connected to an International Direct Dial (IDD) telephone line which currently also operates as a host for the African Association of Universities and the Technology Transfer Centre. With a 2400 baud modem the calls to London are on demand, and polling PADISNET in Addis Ababa has not been successful. A high speed Telebit modem is expected to arrive in Accra. The network connection has been supported by the PADISNET and ELICI WEDNET projects.

KCI-NET:

Based at the Kenya Computer Institute in Nairobi, UNDP have donated equipment and some funding to this initiative. Negotiations have been under way for quite some time to develop this network as a means of disseminating information. One of the main purposes of this project is the promotion of electronic communication within the region. The initial objective is to link up the secretariat of the National Computer Society, the Kenya Computer Institute (KCI) and other institutions in Kenya which have expressed the need for E-mail facilities. The people involved in this project hope that with at least one international gateway node some of those in need of electronic communication facilities would be able to feed into/from it at a substantially reduced overall cost. The gateway may enable some NGO nodes to have access without need for the current high costs of individually X25 networks calls out of Kenya. Another ambition of this project is the initiation of a long term plan to launch a "Regional Centre for Computer Science", whose objectives include:

- The promotion of Computer Science R&D in the region. Already some sections of KCI-NET have identified some areas of software, where immediate small scale production could begin.
- Acquisition and dissemination of wide-ranging information in the region. With this regard AISY (Aids Information SYstem)

The AISY deserves to be mentioned as it was conceived as a means of sharing information on the escalating

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problem of the spread of AIDS in African Countries. It recognizes the need to co-ordinate a network of information. Apparently, it is believed by proponents of KCI-NET that the only real weapon there is against aids is the effective dissemination of information. The system proposed will also facilitate research efforts and will provide "Computer Aided Learning" (CAL), which can be used to "professionally update" paramedical officers and nurses in a more convenient way.

MANGO:

MANGO is a bulletin board service in Harare, Zimbabwe, operated by a collective of NGOs including: Africa Information Afrique (a regional news agency), EMBISA (religious development group), SARDC (Southern African Research and Documentation Centre), EDICESA (Ecumenical Documentation and Information Centre for Eastern and Southern Africa). It was recently agreed that the system be made available to the NGO community as a whole and a fee structure has been developed. MANGO now connects three times daily with the Web FIDO gateway in Toronto. In addition it connects three times a day to Worknet in Johannesburg. The hardware being used for this is a 16MHZ 386sx, 2MB RAM with a 40MB Hard drive and a Telebit 2500 PEP/V.32/19200/9600/2400/1200 baud modem, a VGA colour monitor, and a Panasonic KXP 24 printer. Line testing equipment and telephone jack crimping tool kit are available. The software is the commonly used Front Door V 2.02 mailer/editor and a Gecho 1.00 mail processor, a Redir 1.10, message redirector, a MT 3.20 message logger and a BNU 1.70 Fossil Driver. According to user Liz Feltoe of the Catholic Commission for Justice and Peace:

now that Rob's lent me a better modem, I am finding the system a real pleasure. My only frustrations are with my own lack of knowledge; in this regard, I think the workshop Rob conducted for us a few months ago was really helpful, not only from a technical point of view but also because beginners were encouraged to find they were not alone in their ignorancel AND of course, it is really frustrating g when our phones don't work, but that's a separate issue. Perhaps I should even mention that we have had periods recently when there have been no postage stamps and no airmail letters for a number of days; one feels one's beating "the system" when one can go ahead and get one's e-mail out anyway!

To me, the most important, and therefore the most satisfying, aspects are the fact that no-one else reads my messages before they go out (i.e. we know our phone calls are sometimes monitored, and our faxes are sent from a neighbouring office by a kind person who can. of course, read them) and by the same token, I don't have to rely on anyone else. Also, I have to say, it's a terrific thrill l when a message from the other side of the world pops up on the screen.

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Unlike many of the other nodes, MANGO has a very dedicated system operator who is very helpful to users and provides regular training to new users.

NGONET (AFRICA) at ELCI:

Funded by IDRC and based at ELCI in Nairobi, this network uses FIDO technology to link up to other APC networks in the region: MANGO, ENDA, WORKNET among others. The countries involved are Angola, Botswana, Kenya, Lesotho, Mozambique, Namibia, Tunisia, Senegal, South Africa, Tanzania, Uganda, Zambia, Zimbabwe. The NGONET Africa project is based at the Environment Liaison Centre International (ELCI) in Nairobi where a FIDO Bulletin Board System has been set up to provide a conduit for email traffic in the region and to NGOs worldwide. This is done using a high-speed modem to make daily calls to the GreenNet FIDO gateway in London. The hardware used is a 386SX 20MHZ, 2MB RAM, 80MB disk, Hercules Monochrome monitor, Telebit 2500 PEP/V.32/19200/9600/2400/1200 baud modem, and Panasonic KXP24 printer. There is also some line testing equipment and telephone jack crimping tool kit. Their software is a Front Door V 2.02 mailer/editor, Gecho 1.00 mail processor, Redir 1.10, message redirector, MT 3.20 message logger BNU 1.70 Fossil Driver.

The project is also supporting the MANGO (Microcomputer Assistance for NGO's) FIDO bulletin board project in Zimbabwe and is assisting in the establishment of a third bulletin board system in Dakar and another in Tunis. To provide NGOs with the cheapest access, emphasis is being placed on establishing a series of hosts with high speed modems distributed throughout Africa. These can then provide NGOs with local support and a local call enables connection to the global electronic network. Four prototype hosts are being set up, one for each region of Africa: ELCI in Nairobi, MANGO in Harare, ENDA in Dakar, and ENDA-Arabe in Tunis. Each of these system is equipped with IBM compatible AT or 386 computers with high speed modems (Telebit T2500) providing PEP and V.32 9600 baud protocols. According to the report of a user, Shem Ochuodho of the University of Nairobi, the documentation needs improvement although the help function is reasonable and the support from the system operator is better than the documentation. Telephone line quality does not seem to have been a problem. On the whole the system has been very reliable and has been up whenever I have tried to poll except for a few down times on the weekend. At one point the system was stripping part of the return address on the incoming messages, but now that has been fixed it all works very well.

PADISNET:

Funded by IDRC and UNDP, PADISNET has evolved out of the Pan African Development Information System (PADIS) that is based at the United Nations Economic Commission for Africa (UNECA). The objective of PADIS is to establish a regional information system in Africa which will serve as a conduit for information and data for development, centred around National, Subregional and regional networks. It

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involves an ambitious initiative to link 34 countries into a network of participating development planning centres for the exchange of databases and information using FIDO technology and the GreenNet gateway to London. Although PADIS is based at the United Nations Economic Commission for Africa (UNECA) in Addis Ababa, it also operates a FIDO node on demand to Accra, London, Nairobi, Johannesburg and Washington. In Accra, the Centre for Scientific and Industrial Research (CIR) is participating in the PADISNET project and has established within GHASTINET a 386 PC connected to an international direct dial phone line (needs to be specially ordered). This machine currently also operates as a host for the African Association of Universities and the Technology Transfer Centre. With only a 2400 baud modem, calls to London are on demand, and polling PADISNET in Addis Ababa has not been successful. NGONET Africa and PADISNET project workers have held joint workshops. It is likely that the two projects will be able to share resources in the support of other nodes in Dakar-Senegal (CRAT) and Dar es Salaam, Tanzania (ESAURP).

RECSICX-WIO:

Funded jointly by UNESCO, NOAA (USA), IDRC (Canada), PADIS (Addis Ababa), SAREC (Canada) ICOD, TELLINDUS (Belgium), and CSIRO (Australia), this project is a network supporting marine scientists in the Western Indian Ocean. It is based at the Regional Dispatch Centre in Mombassa, Kenya. Countries involved are Ethiopia, Kenya, Madagascar, Mauritius, Mozambique, Somalia, Tanzania. The main objective of the project is to promote and facilitate communication between Marine Scientists in the Western Indian Ocean region, and provide them with necessary support, including access to a bibliography. To reach the objectives the project provides several services and produces a variety of products. These include:

- **Bibliographic services**

The project provides two bibliographic services. The Query Handling service and the Document Delivery Service. With the first, abstracts can be obtained on any topic in the field of aquatic sciences. For this the project has access to the CD-ROM version of ASFA (Aquatic Sciences and Fisheries Abstracts) or various Marine-related databases on the on-line database system Dialog. With the second service any type of publication in the field of aquatic science can be obtained. The documents are provided through a network of 19 cooperating libraries in Australia, Belgium, Canada, Fiji, France, India, Netherlands, Philippines, U.K. and the USA.

- **The regional library database WIOLIB.**

- **Data products to promote the scientists of the WIO region.**

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Two data products have been set up. The WIODIR, which is the Directory of Marine Scientists of the WIO region; and WIOPUB which contains abstracts of publications of the Marine Scientists of the WIO region.

- The Newsletter WINDOW (Western Indian Oceans Waters).

RECOSCIX-WIO's newsletter is published 3-4 times a year.

RINAF:

Research and Information Network for Africa (RINAF) is funded jointly by UNESCO and the Italian Government. It aims to improve the access to electronic information by African researchers. As stated by its leader Stephano Trumpy (1992), RINAF is a regional informatics network for Africa that aims to coordinate, integrate and upgrade the existing networks in Africa. It is controlled at CENUCE in Pisa, Italy, and appears to have no restrictions as to which countries are involved. RINAF proposes to develop the FIDO technology with UUCP and X25 links. Zambia has been selected as the 'regional node' in the southern African region and Tanzania and Swaziland have been selected as 'national nodes'. Although the project is almost two years old, little has so far been accomplished aside from bringing representatives from Zambia and Swaziland to a strategy workshop in Pisa, Italy last November.

RIO-ORSTOM:

Funded by the French government through Orstrom, the project, RIO Africa (Reseau Informatique de l'ORSTOM), is involved in the setting up of a network which links laboratories in 10 countries. This network, is a member of FNET and EUNET and communicates with other international networks. Controlled in Paris and Montpellier, RIO uses public communication networks RTC or X25, TCP/IP, UUCP to connect to sites in Burkina Faso, Cameroon, Congo, Ivory Coast, Mali, Mauritania, Niger, Senegal, Togo. This network began from a scheme of the French government to direct all scientific data processing that has been developed since 1986. It focuses on the centralization of data processing equipment at the individual level (personal computer), the department level and the supercomputer level (external networking). It uses Unix and compatible machines and ethernet local networks (TCP/IP and NFS), development libraries (GKS, X-Windows). The RIO services are: E-mail, documents and files transmission, electronic form. The RIO uses public communication networks (RTC or X25) and makes do with relatively noisy lines. Its communication nodes are cheap Unix machines. Acting as gateways to local networks of micro-computers, they give non-computer people access to the network services from their personal computers.

UNINET-ZA:

Funded by the South African Foundation for Research and Development (FRD), this is an academic and

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research network among universities and research institutions in South Africa. At present, it is the only Internet connection in Sub-Saharan Africa. Based at Rhodes University in South Africa, this network allows Internet connectivity for users in Botswana, Namibia, Mozambique, Zambia, Zimbabwe, Kenya and Ethiopia. The network runs various protocols, but it is now converging to TCP/IP. UNINET-ZA is connected to the INTERNET through a 9.6 kbps link from Rhodes University to Portland, Oregon; all of Uninet-za's TCP/IP networks are connected to NSFNET.

In 1987 a decision was taken to set up an academic and research network among university and research organizations in South Africa. The task of managing its planning and implementation was assigned to the Foundation for Research Development (FRD). The implementation of the network involved setting up a structure for collaboration among the participating organizations, arranging finance, getting a basic network operational and then extending its scope and improving its function. There are currently 22 organizations participating in UNINET. The first to participate were the large and well developed universities and research organizations, mainly located in the main urban centres primarily in South Africa, but membership is now being extended to smaller and more remote universities. The first networking links were established on an ad-hoc basis, using whatever protocols were available but the network technology is now converging towards the use of TCP/IP as the standard operating protocol. The initial overseas was via a dial-up to USA, this has recently been replaced by a 9600 leased data link to the USA. In fact in November 1991 a dedicated TCP/IP link to the United States was commissioned at Rhodes University in Grahamstown. This link connects Uninet-ZA to RainNet in Portland, Oregon and from there into Altnet and finally into the NSFNET. Uninet-za also run a UUCP to Namibia and Zimbabwe and FIDONet to Botswana, Zimbabwe, Zambia and occasionally Kenya and Ethiopia.

WEDNET:

Funded by IDRC and administered by ELCI in Nairobi, this network uses the GreenNet gateway in London. The WEDNET (Women in Natural Resource Management) project aims to link researchers in different countries via electronic communication and conventional networking. It operates a Bulletin Board System links to the GreenNet FIDO gateway in London and Poptel/Geonet. Countries involved in this initiative are Burkina Faso, Ghana, Kenya, Senegal, Sudan, Zambia, Zimbabwe. WEDNET began with a meeting of researchers from Africa and Canada. The electronic component of the project is focused on investigating possible electronic links between researchers in African countries, as well as among associated researchers and a coordinator in Canada at the methodology development stage. The desire for direct communication between African researchers has been a goal which could only be met through interconnected bulletin boards across the African continent. Resources within the Wednet budget have limited this to beginning bulletin boards in Harare to serve Wednet researchers in Southern Africa and highlighted the need to develop and connect similar systems in Nairobi and Dakar to serve Wednet researchers in East and West Africa.

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WORKNET:

Funded by its users and other members and based in Johannesburg, South Africa this is a Fido host that links to GreenNet in London and Mango in Harare. Worknet offers mailbox facilities, conferences, an international gateway, training and users support to the progressive NGO community in South Africa. In South Africa, Worknet operates as the national electronic network host for NGOs. The network has been established for about three years, and now has about 140 users on a multi-user BBS program called MajorBBS. Users include the labour movement, Human rights groups, the alternate press, documentation centres, church groups and service organizations. The ICFTU (International Congress of Free Trade Unions) has funded the development of gateway software which allows MajorBBS users to send messages to other systems and obtain/post to online conferences. The Major BBS format is converted to the FIDO standard and a separate machine operates as a FIDO node to transmit and receive the messages. The FIDO machine is now officially registered on the Internet and is in daily contact with MANGO-BBS in Harare and the GreenNet FIDO gateway in London via high speed modem (PEP). An X25 leased line has been set up.

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Table 1. Network Connectivity. *Source: Larry Landweber April 15th 1993.*

Country	FIDONet	UUCP	Satellite	Bitnet	Internet
Algeria	X			X	
Botswana	X				
Burkina Faso	X	X			
Cameroon		X			
Congo		X	X		
Cote D'Ivoire	X	X		X	
Djibouti			X		
Egypt	X	X	X		
Ethiopia	X				
Gambia	X	X			
Ghana	X		X		
Kenya	X	X	X		
Lesotho	X	X			
Mali	X	X			
Mauritius		X			
Morocco	X				
Mozambique	X	X	X		
Namibia		X			
Niger		X			
Nigeria	X				
Rwanda	X				
Senegal	X	X			
South Africa	X	X			X
Sudan			X		
Swaziland	X		X		
Tanzania	X		X		
Togo		X			
Tunisia	X	X		X	X
Uganda	X		X		
Zambia	X		X		
Zimbabwe	X	X	X		

Appendix II

Transcripts of Steering Group Meetings

The First Steering Group Meeting on Tuesday 2nd September 1993 3pm GMT

NCST (?) hello NCST here

NCST (?) is there anyone out there in London ?

Comsec (?) hi NCST

Comsec (?) how are you?

NCST (?) NCST here. Where are you (for COMNET meeting)

NCST (?) hi Comsec NCST here

Comsec (?) I'm here!

NCST (?) Great. Is there a particular "Room" we are supposed to go to ?

Comsec (?) I don't know where the others are - Coordinator is in the process of joining

NCST (?) I spoke to IIM in a more conventional manner (phone)

Comsec (?) us, and ULCC and IIM should be around - but where I do not

Comsec (?) know

NCST (?) IIM said he will join us on this

Comsec (?) the reason I am late is that M. has kept me on the 'phone for a long

Comsec (?) while - I think he is due to see you next week

NCST (?) where is he hiding ? I could not reach him on the phone at all

NCST (?) do give me his phone number if you have it

Comsec (?) he is in Delhi at the moment - at the Sheraton

Comsec (?) M.'s phone number is 11 301 0101 room 1424

NCST (?) do you have the number of the sheraton. no hurry you can email it later

NCST (?) thanks

IIM (?) Hey folks I have just joined in IIM

Comsec (?) hi IIM - how are you?

IIM (?) Fine sorry to be late in logging

Comsec (?) also - where are you?

NCST (?) hi IIM

Comsec (?) don't apologise for being late - we are still waiting for ULCC

Comsec (?) and Coordinator

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IIM (?) At ahmedabad connected via dial up to ncs

Comsec (?) remember to bill us for the dial up charges!!

IIM (?) Thanks I don't forget such things

Comsec (?) !!

IIM (?) What is happening to the News letter funding. I was discussing with
IIM (?) M. the possibility of distributing it electronically

Comsec (?) DB has indicated that he is willing to put significant funding
Comsec (?) towards the newsletter (no definition of significant) - he mentioned
Comsec (?) that he would be meeting with you soon and so I had suggested that he

IIM (?) We must have something firm by October.

Comsec (?) discusses future strategies for the newsletter etc. with you and then we
Comsec (?) both put our money in accordingly.
Comsec (?) Coordinator has just told me (physically) that she is having problems in
Comsec (?) joining the bulletin board

IIM (?) He has indicated that he will be in Ahmedabad in November

Comsec (?) oh - dear - we will need to get something sorted out before then
Comsec (?) what I suggest is that I send some funding to keep things going - and
Comsec (?) then we look at the overall package after November

IIM (?) That sounds good

Comsec (?) The delay between sending a message and seeing the response on this

IIM (?) Who else is going to join us today

Comsec (?) bulletin board is rather confusing
Comsec (?) we are hoping that we will get ULCC and Coordinator - Shem Ochuodho
Comsec (?) was invited but was having technical problems - he will probably not be
Comsec (?) joining this time

IIM (?) I should let it be known that IIM(code name) = IIM(real name)

Comsec (?) why 'IIM'?

IIM (?) I thought I was giving a password and not user name.
IIM (?) NCST are you there.

Comsec (?) While we are waiting for the others - did you see the points listed for

NCST (?) very much here

Comsec (?) an agenda by Coordinator?

NCST (?) yes. i have the printed copy of the agenda in front of me

Transcripts of Steering Group Meetings

Comsec (?) IIM?

IIM (?) Yes Can we discuss dates for NCST's program so that we can carry an IIM (?) announcement in Oct news letter.

NCST (?) we can discuss a possible date

Comsec (?) I hope that NCST can firm this up with M. during the next week or Comsec (?) so

NCST (?) good. i can do that

Comsec (?) The proposal looks very good - I know that M. is keen that it is held Comsec (?) under the banner of ICCC and COMNET

NCST (?) do you have any comment about the timing, Comsec ?

IIM (?) Will participants have to be sponsored through COMSEC POC's because that IIM (?) takes a lot of time.

Comsec (?) not really - there are not other events which it needs to tie in with

NCST (?) Comsec, is it possible to get a hard copy of this later, so I don't need to NCST (?) take notes ?

Comsec (?) tightly - so the main determinant should be the suitability for the Comsec (?) institutions and toe maximum recruitment of participants
Comsec (?) Coordinator is now sitting here with me and she says that it is not possible Comsec (?) to print a hard copy direct from the b/board - so either do screen dumps Comsec (?) or she will arrange for a hard copy to be mailed to you later as the

NCST (?) OK. Fortunately, I have a printer attached. I am just doing an NCST (?) occasional

Comsec (?) system operator is able to do this.

NCST (?) screen dump.

Comsec (?) Coordinator tells me that (unbelievably!!) ULCC has lost his pass word

NCST (?) I would highly appreciate receiving an Email copy of the transcript NCST (?) if it is possible.

Comsec (?) and there are no humans available in the cluster team so no one can get Comsec (?) him into the board.

NCST (?) They say poetic justice!

Comsec (?) Frustratingly I think that we must conclude that this is a brief test of Comsec (?) the system

NCST (?) I think he just came in as sysop
sysop (?) hello

Transcripts of Steering Group Meetings

Comsec (?) sysop- please can you get ULCC onto the board - he has lost his
Comsec (?) password

NCST (?) hi ULCC

sysop (?) sysop = ULCC
sysop (?) I'll have a word with ULCC..

Comsec (?) ULCC - thanks

sysop (?) back in a mo

Comsec (?) I think that we have lost IIM

NCST (?) I do think so

Comsec (?) If we continue - even though we are only 2 (+Coordinator over my shoulder)
Comsec (?) the first item I wanted to raise was the proposed programme for the

NCST (?) I believe that IIM will come back

Comsec (?) network of research institutions and the how to join the network pack
Comsec (?) I assume that all is going well - and that the discussions with M.
Comsec (?) will clarify any points

NCST (?) OK. I was glad to hear that you think the programme sounds good

Comsec (?) did you get the material from ML - from Rhodes University - he
Comsec (?) was claiming to have some relevant 'how to join' material and software

NCST (?) Yes. I am sure that any clarifications necessary can be
NCST (?) handled over the phone to M. If he is passing through Bombay

sysop (?) ok - ULCC will be on in a moment
sysop (?) he will be using my account as he can't use his own

NCST (?) it will be even better. I can have a half-an-hour discussion with him
NCST (?) and iron out any problems that remain.

Comsec (?) one point that needs tidying up - the 'say' prompt should be followed by
Comsec (?) about 4 lines for text - it is disconcerting to have half a thought sent

NCST (?) Comsec, about ML

Comsec (?) and it would be better if it could store up a whole paragraph before it
Comsec (?) has to be sent

NCST (?) ML. Is this the same material B sent out ?
NCST (?) starter kit for environment ?

Comsec (?) NCST - no
Comsec (?) ML sent us an e-mail which Coordinator forwarded to you - it simply said

Transcripts of Steering Group Meetings

NCST (?) I don't recall any other material.

NCST (?) I will look through any pending Email and read it.

Comsec (?) that he had undertaken extensive work in developing appropriate

NCST (?) Did Coordinator send it to me ?

Comsec (?) protocols and software in MS-DOS - Coordinator says that it was sent but will

Comsec (?) send a further copy

Comsec (?) If you can do a FTP you can get the material from the machine at Rhodes

Comsec (?) Coordinator will send you an e-mail with details

NCST (?) Good. I will pick it up. I am sure I will Coordinator's Email.

NCST (?) I meant "I will locate Coordinator's Email"

Comsec (?) Moving on - we have been approached by some euro-people interested in EC

Comsec (?) funding - we are pursuing this

Comsec (?) they are particularly interested in funding low cost systems which will

NCST (?) Comsec and Coordinator, I went out for some reason.

Comsec (?) allow management development institutions in the SADACC region to share

Comsec (?) material

Comsec (?) I was hoping that the research we had commissioned SO to undertake

NCST (?) I don't what I did. But the system threw me out. Now I am back.

Comsec (?) would tell us something about the possibilities here - given the

Comsec (?) existing state of the local networks in that region

Comsec (?) NCST - welcome back - I don't know why you were ejected!

NCST (?) Yes. I was.

ULCC (?) hi ... it's ULCC, despite this saying ULCC ... I've borrowed him

NCST (?) You said something about funding. "they are particularly interested"

Comsec (?) hi ULCC - about time!!

NCST (?) Who are "they"

ULCC (?) sorry

Comsec (?) NCST - sorry - you lost the first part of the message. There is some

NCST (?) HI ULCC. NCST here

ULCC (?) hi all

NCST (?) Pardon my bad typing

Comsec (?) interest in funding the GOVERNET proposal - specifically for encouraging

Transcripts of Steering Group Meetings

Comsec (?) low cost networking between management development institutions in the
Comsec (?) SADACC region

sysop (?) if anyone wants to record what is said in here type .record
sysop (?) it will then be mailed to your address when u log out

NCST (?) where will the record be available ?
NCST (?) thanks

Comsec (?) sysop- thanks - how clever

sysop (?) no problem.

Comsec (?) ULCC - to bring you up to date - we have lost IIM - he was here a
Comsec (?) moment ago - but was then ejected - the same fate befell NCST but he
Comsec (?) was able to get back in
Comsec (?) Shem has not been able to join us and Coordinator is sitting over my shoulder

NCST (?) I am very much here

Comsec (?) as the system will not allow entry at the moment

ULCC (?) first time I've seen a multiway talk like this

Comsec (?) ULCC - we have discussed the proposal for a programme run by NCST and

ULCC (?) did SO have network probs also

sysop (?) it takes a bit of getting used too.

Comsec (?) IIM as set out on the agenda for this meeting under the heading of
Comsec (?) network of research institutions

NCST (?) I suggest that one of us should chair this session. Comsec, would you ?

Comsec (?) the ComSec will probably fund the proposal - M. will meet with
NCST

NCST (?) the idea is that you call someone by name and he/she responds.

Comsec (?) soon to discuss details - before we move on - any thoughts or comments
Comsec (?) about that proposed programme?

NCST (?) So, we will avoid two people talking in parallel

ULCC (?) agreed

Comsec (?) I'm happy to chair - I'm not quite sure how - I will just indicate the
Comsec (?) current topic and indicate when we have moved on

NCST (?) OK

Comsec (?) on that basis - the current topic is to wind up our discussion on item 2

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NCST (?) JS, have you seen the agenda ?Coordinator sent out ?

ULCC (?) yes

Comsec (?) of the agenda - ULCC - every one else has shared their comments - any

ULCC (?) no

Comsec (?) points you wanted to raise about the network of research institutions
Comsec (?) proposal?

ULCC (?) no

Comsec (?) ok - item 3 - GOVERNMENT

Comsec (?) we were hoping to have heard back from Shem who was undertaking some

Comsec (?) quick and dirty research to give a feel for the real state of existing

Comsec (?) networks in Africa - and the possibility for developing a useable

NCST (?) Comsec, what is the basic thrust of Government ?

Comsec (?) network (electronic - fidonet) between management dev. institutions in

Comsec (?) Africa/

NCST (?) Thanks

Comsec (?) NCST - the basic thrust is to provide a means to allow the major

Comsec (?) training institutions (public sector) share material, curriculum and

Comsec (?) other details, very particularly in relation to training programmes

Comsec (?) concerning civil service improvements/admin. reform etc.

NCST (?) OK

Comsec (?) our original thinking was to keep the proposal very cheap and cheerful -

Comsec (?) use the existing networks - look for funding to cover the dial up

Comsec (?) charges etc.

Comsec (?) we are still proceeding on that basis , but inevitably the ec people are

Comsec (?) indicating that we need to heighten the capital element if it is to be

Comsec (?) fundable from the EC

NCST (?) By EC do you mean the European Community ?

Comsec (?) yes

NCST (?) I have a comment on that.

Comsec (?) please...

NCST (?) It turns out that Africa faces the same problem we face.

NCST (?) From our experience we have a suggestion for them.

Comsec (?) expand

NCST (?) Most of our institutions are unable to find even 3,000 USD per year for

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NCST (?) I mean even three thousand US D s per year for Email
NCST (?) So, any way we have of reducing annual expenditure by a one time
NCST (?) expenditure will help the institutions
NCST (?) I mean institutions
NCST (?) There is a satellite communication option.
NCST (?) So, if Europe is willing to give Africa a gift,
NCST (?) we can draw up a shopping list which is cost effective and useful
NCST (?) over

Comsec (?) we are developing the proposal together with a retired ec official who
Comsec (?) is acting as a guide through he labyrinth
Comsec (?) today - he brought a person fro Zambia to see me specifically to talk
Comsec (?) about how our proposal for a management development institutions network
Comsec (?) in the SADACC region might be upgraded by introducing the element of vsat
Comsec (?) communications

NCST (?) good to hear that.

Comsec (?) the stage we are at with the proposal is that we are preparing a rough
Comsec (?) draft, for this adviser to tidy prior to his visiting Brussels to tout
Comsec (?) for interest
Comsec (?) can we share the first draft with you (in a few weeks) so that you could
Comsec (?) add in your dimension before we proceed?

IIM (?) I am back again after some struggle.

Comsec (?) over

NCST (?) I would be happy to comment on the draft
NCST (?) welcome back IIM. Comsec is now "chairing" the session

Comsec (?) IIM - ULCC is with us under the stage name of ULCC

ULCC (?) hi IIM

Comsec (?) I am chairing and we have reached the topic of GOVERNET on the a
agenda

Comsec (?) any further observations on the GOVERNET proposal?

NCST (?) I second the proposal.

Comsec (?) lets move on to the X500 section - ULCC - any developments?

ULCC (?) I've set up an organisation under the UK
ULCC (?) for the Commonwealth Sec alias comsec
ULCC (?) it has basic info
ULCC (?) on the comsec COMNET IT task forces
ULCC (?) I believe you can interrogate the X500
ULCC (?) directory from this BB my entering one of the menu
ULCC (?) options ... this set up a while back
ULCC (?) I could not get the Commonwealth agreed as a top level "locality"
ULCC (?) but the world is happy to see it as a top level organisation.

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ULCC (?) however, may be best to populate it under a temporary
ULCC (?) entry for comnet-it under the commonwealth Sec for now??
ULCC (?) o

Comsec (?) ULCC - the problem of placing the Commonwealth as an organisations
Comsec (?) that it limits our using the directory as a way of encouraging
Comsec (?) intra-Commonwealth collaboration

ULCC (?) agreed my suggestion:

Comsec (?) ideally, we would like to be able to call up groups of people (say
Comsec (?) journalists, or other groups) who are based in Commonwealth countries

ULCC (?) set up an organisation under each Commonwealth Country called
ULCC (?) COMNET-IT
ULCC (?) they have agreed to this

Comsec (?) what is the problem in getting the Commonwealth located as a locality or
Comsec (?) region?
Comsec (?) over

ULCC (?) well locality implies a geographic continuous region
ULCC (?) the only current precedent is Europe
ULCC (?) o

Comsec (?) it might not be an issue yet - but how will the directory handle entries
Comsec (?) from locations which are protectorates of other distant countries -
Comsec (?) locality does not automatically imply a physically joined region
Comsec (?) are there any avenues for putting in some pressure or diplomatic
Comsec (?) efforts?
Comsec (?) over

ULCC (?) as long as the country is registered we can register COMNET-IT
ULCC (?) directly below it as an organisation.
ULCC (?) but I agree, we need to be flexible so we can perhaps
ULCC (?) take account of all the problems as time goes on
ULCC (?) I don't think any of this is a show stopper
ULCC (?) in the first instance though ??
ULCC (?) o

Comsec (?) IIM - NCST - any thoughts?

NCST (?) how do they list the UN ? Under the USA ?

ULCC (?) no ... UN is registered as an organisation at the top level

NCST (?) Then why not the Commonwealth ?

ULCC (?) no problem we can put commonwealth in as org at top level
ULCC (?) I've agreed this but problem:
ULCC (?) most directory user interfaces don't search for orgs at top level
ULCC (?) so whilst we can put it their, we then become invisible to many
ULCC (?) users that wish to find data on people

Transcripts of Steering Group Meetings

ULCC (?) unfortunately most common interfaces are a bit dumb yet for X500

NCST (?) is that not a bug to be found and "sprayed"

ULCC (?) and have a picture of the world as country/org/dept/person only!

ULCC (?) o

ULCC (?) not so much a bug as a feature of X500 products, I guess

Comsec (?) ULCC - pursuing the point about any possibilities for putting on some

NCST (?) In any case, I think we must list the Commonwealth as the

Comsec (?) pressure..

Comsec (?) who decides the issue about localities etc?

NCST (?) British Commonwealth". The word Commonwealth is not precise enough

ULCC (?) well currently the PARADISE Project decides

NCST (?) Sorry, I did not mean to shout. I don't know why the software said that.

Comsec (?) who is in PARADISE?

NCST (?) ULCC is !~

Comsec (?) ULCC... ??

ULCC (?) a UK consortium, India in France, RARE operational Unit

Comsec (?) ULCC - we'll pursue this further late perhaps, in the meantime is there

ULCC (?) well I am part of the UK con

Comsec (?) any readable brief summary of the X500 project and explanation of what

Comsec (?) it means to have the Commonwealth (not the British Commonwealth) as a

Comsec (?) high level organisation?

ULCC (?) yes ... some good brochures on the project I could send by post

ULCC (?) to you ...

Comsec (?) we have lost NCST again - IIM - are you there?

ULCC (?) I think we've lost NCST?

IIM (?) Yes I am listening.

ULCC (?) he's back ...

NCST (?) I am back again.

Comsec (?) I want to move on to the ICGITD project - item 5 - welcome back

NCST

Transcripts of Steering Group Meetings

ULCC (?) OK

NCST (?) Good. Let us move on.

Comsec (?) The ICGITD is a nice if rather elaborate idea - it would place COMNET in

Comsec (?) an ideal position to eavesdrop on pre-project planning amongst the
Comsec (?) great and the good - CIDA seem to be interested in providing some basic
Comsec (?) funding
Comsec (?) any thoughts on the proposal?

NCST (?) I wonder if we will end up spending more on overheads like this
NCST (?) than on delivering networking to the needy

Comsec (?) fair comment - I think thought hat the costs should be negligible -
Comsec (?) other than in human effort -

IIM (?) I Think Its a good idea to rope in other donors Can we have a workshop

Comsec (?) The ICGITD proposal was suggested at a workshop earlier this year - I
Comsec (?) think that we need other donors interested, but I am assuming that this

NCST (?) If it does not cost us much, it is OK.

Comsec (?) will have to be project by project. The ICGITD is not a particularly
Comsec (?) useful project in NCST's terms (his point is embarrassingly
Comsec (?) appropriate) - but it would give us a profile and help us keep within
Comsec (?) the right networks to position us for other requests from donors

NCST (?) I do agree that there is some value in coordinating with the other
NCST (?) actors on the scene

Comsec (?) ULCC - any thoughts?

ULCC (?) I think NCST is correct we have to watch the overheads in
ULCC (?) all this, but at this stage a high profile is important
ULCC (?) perhaps simply to generate credibility for the COMNET-IT project
ULCC (?) o

Comsec (?) item 6 - the UKOLN proposal
Comsec (?) NCST's friend JS is busily seeking funding at this very moment
Comsec (?) for his DWINS project which, as far as I understand it, will allow every
Comsec (?) known method of electronic communication to access a database of
Comsec (?) development literature - so it will serve as a highly accessible
Comsec (?) resource/database - and a test bed to assess which method is useful
Comsec (?) given dial up costs. local telecoms problems, etc. etc.
Comsec (?) the project still has the flavour of using little kids chocolate bars -
Comsec (?) but it really does cost us nothing - JS simply wants our

NCST (?) why do you say that, Comsec ?

NCST (?) He is not asking developing countries to further activity

Transcripts of Steering Group Meetings

Comsec (?) blessing so that he can request funding while sounding plausible

ULCC (?) aside: who is JS??

Comsec (?) JS is the coordinator at the UK office for library networking

NCST (?) He is Project Officer for Library Networking, UK

Comsec (?) based at Bath

ULCC (?) ta

Comsec (?) he did a presentation at ULCC recently

ULCC (?) oops ... should have known that I know of him then.

NCST (?) who is seeking the funds from ?

Comsec (?) off hand I'm not sure - Coordinator has the details she tells me deep in a Comsec (?) file

Comsec (?) She will let you know subsequently - the Commonwealth of Learning is in Comsec (?) there somewhere

NCST (?) Canada.

Comsec (?) I need to begin wrapping things up for this initial and experimental Comsec (?) session

NCST (?) OK

Comsec (?) there are many issues outstanding - not the least being does all this

Comsec (?) add up to a coherent basis for an organisation

Comsec (?) other questions include my feeling that we should invite other active

Comsec (?) people onto the steering group

NCST (?) You had two names. Who are they ?

Comsec (?) the formal constitution for COMNET-IT needs some consideration as it

Comsec (?) implies a membership-based organisation, and I do not know whether we

Comsec (?) have the basis for that

Comsec (?) could we suggest some possible times for a further meeting examining

Comsec (?) these points

ULCC (?) I agree, needs as much energetic input as possible

Comsec (?) I have in mind the week beginning 18th October

ULCC (?) looks good for me

Comsec (?) ULCC - could you explain the pedigree of Randy Bush and Geoff Sears?

NCST (?) looks good to, me too, except for Oct 21

Transcripts of Steering Group Meetings

Comsec (?) IIM - any problems with that week?

ULCC (?) don't understand

IIM (?) I am OK

Comsec (?) ULCC - NCST was asking who the people were that we were thinking of

Comsec (?) inviting onto the steering group - these are they - you know their

Comsec (?) backgrounds

ULCC (?) no are they academic's?

Comsec (?) I suggest 4 p.m. London time on Monday 18th October

ULCC (?) OK ... it's in my diary now.

Comsec (?) sorry ULCC - I thought that the names had come from discussions with you

NCST (?) can we make it 3 PM GMT ? Is it the same ?

ULCC (?) not me gov

ULCC (?) oops I meant "guv"

Comsec (?) 3 p.m. GMT is fine - NCST - could you let IIM know - he's gone

NCST (?) ok. i will let him know.

ULCC (?) yes watch out for UK clock change, local time is GMT in Oct???

Comsec (?) ULCC - yes

Comsec (?) thanks for sticking through this - its fun but its quite hard work!

ULCC (?) need practice ... I guess

NCST (?) one moment.

NCST (?) I have two quick points.

NCST (?) I disown any references to..

Comsec (?) noted

NCST (?) They may pls be deleted from the record. Surely software is to take the

NCST (?) blame.

Comsec (?) I blame ULCC's staff

ULCC (?) so do I you just can't get 'em these days :-)

NCST (?) Secondly, you mentioned ICCA association with the proposed workshop.

NCST (?) I have talked to ICCA. The Executive Committee will be very

NCST (?) happy to cooperate with COMNET-IT. But to make the activities

NCST (?) manageable, I would suggest a workshop under comnet it only

NCST (?) and a separate (but adjacent in time and place) even t

NCST (?) under joint sponsorship. This could be a two day symposium,

Transcripts of Steering Group Meetings

NCST (?) seminar, conference, or something like that.

ULCC (?) Time and Tide and British Rail wait for no man

NCST (?) I guess it would be difficult to make it a full conference. But

NCST (?) could be a

ULCC (?) Sorry but must leave soon.

NCST (?) working conference"

NCST (?) I did not shout

Comsec (?) fine - it was primarily a point about presentation

NCST (?) OK. we can wind up now.

Comsec (?) could you discuss this with M.

Comsec (?) bye

NCST (?) I will discuss it with M.

NCST (?) Goodnight everyone. Bye

ULCC (?) Yes ... it's been good

ULCC (?) bye

ULCC (?) q

NCST (?) q

Transcripts of Steering Group Meetings

Second Steering Group Meeting on Weds 27th at 13:44:04 October 1993

ULCC (?) help

ULCC (?) is any one there

Comsec (?) yes - someone is here

ULCC (?) hi it's ULCC 'cause ULCC(code name) not recognisable

Comsec (?) ULCC- I could recognise you anywhere

Comsec (?) how are you

ULCC (?) finr ...opps fine, I've been away for a few days

Comsec (?) somewhere nice??

ULCC (?) my typing always bad when I get back

ULCC (?) No well we enjoyed it ... Broadstairs

ULCC (?) I've a friend with a hotel there!

Comsec (?) are you busy?

ULCC (?) standard answer = yes

Comsec (?) but really??

ULCC (?) actually , we are a bit just now

Comsec (?) why particularly?

ULCC (?) seems to have a long list of outstanding things

ULCC (?) no special reason, I guess this is life now

Comsec (?) I've forgotten how to shout - how do we do that?

Coordinator (?) Hi there, any sign of NCST and IIM ?

ULCC (?) type .s

ULCC (?) no wasn't that

ULCC (?) hi

ULCC (?) type .shout then what you want to shout!

Comsec (?) I don't understand - how did you shout?

Comsec (?) Am I shouting now?

ULCC (?) at "say" prompt, enter .shout

ULCC (?) yes

Comsec (?) how do I stop?

ULCC (?) not sure what it does though except put "shout" on front of line

Comsec (?) doesn't it mean that you can wake people up, or let them hear in other

Transcripts of Steering Group Meetings

Coordinator (?) it allows people in other rooms to hear the conversation

Comsec (?) rooms

ULCC (?) sounds like Cludeo!

Comsec (?) I did it in the library with the lead pipe

Coordinator (?) yes very much

Coordinator (?) couldn't hear you

ULCC (?) I don't wish to know what you do with lead pipe ??

Comsec (?) Coordinator - did everyone get an agenda?

ULCC (?) :-)

ULCC (?) no

Coordinator (?) yes, I sent it off on thursday

ULCC (?) by Royal Mail or by email?

Coordinator (?) email

ULCC (?) hang on

Coordinator (?) did you receive it ULCC?

Comsec (?) where has everyone gone?

Coordinator (?) I am still here, but don't know where ULCC and the others are.

Comsec (?) did NCST and IIM confirm?

Coordinator (?) Both IIM and NCST have confirmed for today - shall I call them ?

Comsec (?) not yet - they might be having problems logging on

Coordinator (?) I presume that 1.30 gmt is the same as 1.30 london time

Comsec (?) I wonder!!

Coordinator (?) let me call them

ULCC (?) hi ... sorry, lost connection

ULCC (?) now got an agenda ... was indeed in my mail ... ta

Comsec (?) ULCC- while Coordinator is calling NCST and IIM, tell me how

Comsec (?) to get out of the command mode

ULCC (?) err ... not sure what mode that is

ULCC (?) I'm a complete novice at this

Transcripts of Steering Group Meetings

Comsec (?) I did something and now the prompt says command
Comsec (?) I have to type .say every time

ULCC (?) hmm ... I'll ask the guru, hold on
ULCC (?) OK this is it:
ULCC (?) a dot "." as first char on line puts you into command mode
ULCC (?) an apostrophe "'" as first char puts you into "say mode

SYSTEM:Wed Oct 27 14:00: Another hour passes....

Comsec (?) OK - thanks

ULCC (?) for completeness, a double quote as first char " puts you in shout mode
ULCC (?) Tell you what, I'll organise a paper copy of the instructions for this

sysop (?) there is a help page for the talker.. do .help

ULCC (?) to go round by email
ULCC (?) as Sysop says there is indeed .help but this I guess wants
ULCC (?) to be studied at leisure I'll get 'electronic' paper version
ULCC (?) sent round the list I thing this may well be of use.

Comsec (?) sysop (Sysop) - NCST has just 'phoned - he has lost his log in code
Comsec (?) what should he do?
Comsec (?) Sysop - I think that you've dozed off

ULCC (?) hang on I'll go ask

Comsec (?) hi IIM

IIM (?) hi

Comsec (?) NCST has locked himself out
Comsec (?) sysop is trying to work out how to get him in

IIM (?) whqaaaat are we discussing

Coordinator (?) You managed to get in NCST , great !

Comsec (?) as yet nothing! - the problem of getting everyone logged in has taken
Comsec (?) over the agenda for the minute

sysop (?) ok - NCST's password is going to be reset to nothing..

Comsec (?) so what does he need to enter as login?

sysop (?) just NCST - but give us a few mins for it to be changed...

Comsec (?) thanks!!

Coordinator (?) He needs his password and the address
Coordinator (?) atdl

Transcripts of Steering Group Meetings

ULCC (?) hi ... i'm talking to NCST on phone now

ULCC (?) he's got to the machine ... now logged

Coordinator (?) Yes he cannot get in through egate

Coordinator (?) I gave him both the clus1 and egate addresses

sysop (?) it would seem he has made it

Comsec (?) Sysop - thanks

NCST (?) Coordinator I am in here

sysop (?) Comsec no problem.

ULCC (?) ok we've got him in now

Coordinator (?) Great, you made it

Comsec (?) I think that we have everyone we were expecting - so I am keen that we

Comsec (?) begin

NCST (?) many thanks, ULCC

ULCC (?) ok

Coordinator (?) please

Comsec (?) I am proposing to chair - and if it is OK I will be a little tough as I

Comsec (?) have got to finish at 3

NCST (?) where are we now. Go ahead., Comsec.

Comsec (?) Coordinator had sent out an agenda - and the first item concerns COMNET

Comsec (?) membership

Comsec (?) we have a working constitution just to enable us to hold small project

Comsec (?) funds etc., but it does not quite fit the bill. It describes COMNET as

Comsec (?) a membership - based organisation

Comsec (?) It might be i the future - but right now it is a small group of people

Comsec (?) trying to push through some innovative projects

Comsec (?) should we have a different constitution that does not use the language

Comsec (?) of members etc.??

NCST (?) seems to be a necessity

Comsec (?) IIM/ULCC- and thoughts?

ULCC (?) nothing specific

IIM (?) I think we need members to work with alike minded reference group

Comsec (?) IIM - could you expand?

IIM (?) I don't mean any kind of "contributing" members for funds but just

Transcripts of Steering Group Meetings

IIM (?) professionals who will network together like in our IFIP working group

Comsec (?) Is that the point that we hoped to cover when we initially thought about
Comsec (?) setting it up as a series of task forces - i.e. for each area of

NCST (?) should they have control over the funds ?

Comsec (?) activity, we, the core group, would pull together like minded profs. who
Comsec (?) would assist in discussing/developing/disseminating that activity?

IIM (?) Can we keep the question of funds separate from activities

Comsec (?) I had forgotten about the 'over' protocol - could we revert to saying
Comsec (?) over' at the end of our point?
Comsec (?) over

ULCC (:)=)

Coordinator (?) should members be responsible for activities or just participants ?
Coordinator (?) over

IIM (?) Control of funds could be with a steering committee over

Comsec (?) I suggest that we, the Steering Committee, should be responsible for
Comsec (?) funds, and that the issue of membership be toned down so that it means
Comsec (?) that for each area of activity, we interest like minded people as we can
Comsec (?) over

ULCC (?) looks ok ... over

IIM (?) But do we call these interested people members of COMNET_IT over

Comsec (?) We have lost NCST for the moment - I presume a technical problem

ULCC (?) yeah this happened before

Coordinator (?) Do we have/need a criteria for collaboration ? over.

Comsec (?) I think that we could call them members - but that we should see them as
Comsec (?) contributors/collaborators rather than more passive fee-paying members

IIM (?) Thats OK over

Comsec (?) it seems a complicated point to pursue i this fragmented way - so I am
Comsec (?) suggesting that I circulate a proposal which we could discuss next time,
Comsec (?) over

IIM (?) Fine what next then over

Comsec (?) I hope that NCST can find us again!!
Comsec (?) next is the question of extending the core group - the Steering
Comsec (?) Committee

Transcripts of Steering Group Meetings

Comsec (?) the original cast list included people more by accident than by careful

NCST (?) I am back again. sorry for the dropping out.

NCST (?) /

Comsec (?) plan - and realistically PS and RS are not

Comsec (?) going to maintain any active interest

Comsec (?) we have an impressive and growing list of project proposals - and as we

IIM (?) I think each task force can identify 1-2 possible additions.. over

Comsec (?) will hear later there is now some real possibility of significant funds

Comsec (?) - so we need to expand our core strategically

Comsec (?) I am suggesting that we invite MJ and CM to join

Comsec (?) Coordinator - could you say a little bit about these 2, over

Coordinator (?) MJ:

Coordinator (?) is considered to be the technical network guru for Africa, he has

Coordinator (?) developed low cost electronic mail systems that can function in very

Coordinator (?) poor conditions: basically he has the hands on knowledge for Africa

Coordinator (?) He is, South African and is currently working as a freelance technical

Comsec (?) On the basis that we are speaking in confidence, I can add that CM

Coordinator (?) expert doing consultancies for PADIS and Worknet amongst other things

Comsec (?) CM is considered to be technically expert, and, based at Makerere

Coordinator (?) Comsec, would you like to say something about CM..

Coordinator (?) over

Comsec (?) Uganda, is about the only identified expert in Africa who is by origin

Comsec (?) African

Comsec (?) he comes with good recommendation

Comsec (?) I should add that our previous hope in this direction - SO -

Coordinator (?) May I add the CM has really done a marvellous job at his

Coordinator (?) node in Makerere

Comsec (?) has disappeared without trace probably due to some fairly vicious

Comsec (?) in-fighting between universities in Kenya which has probably cost him

Comsec (?) his job (no corroboration for this)

Comsec (?) over

NCST (?) both seem to be promising/ i will type "/" to mean "over" /

ULCC (?) I never got a reply from that email address you

ULCC (?) gave me for SO ... over

IIM (?) Yes I am aware of it.. over

Coordinator (?) We do need an African expert for Governet though ..over

Comsec (?) inviting them to join would enable us to look more credible with the

Transcripts of Steering Group Meetings

Comsec (?) Governet proposal - so could I take this as agreement to invite them

IIM (?) I think SO is controversial in Kenya. over

Comsec (?) over

Coordinator (?) Does anyone else know of CM ?

Coordinator (?) over

NCST (?) i don't /

IIM (?) NO over

ULCC (?) no ... I like over = / /

Comsec (?) I propose that we circulate a short cv for them both - and seek

Comsec (?) agreement to formally invite them to join at the next meeting - please

Comsec (?) object if this is not acceptable/

NCST (?) GA - meaning Go Ahead in networkese /

ULCC (?) OK from me details for the directory would be good,e.g email/

Coordinator (?) Apparently CM's node has grown significantly in the past year

Coordinator (?) a good idea..over

Comsec (?) next item

Coordinator (?) COMNET-IT workshop

Coordinator (?) over

Comsec (?) The COMNET-IT workshop planned for next March

Comsec (?) NCST - we are waiting to get an estimated cost - any progress?

Comsec (?) over

NCST (?) yes. I have two emails ready to send you. one contains

NCST (?) airfare information for an 18 participant workshop being

NCST (?) run in bangalore at the moment.

NCST (?) the other contains hotel rates from a number of

NCST (?) competitive hotels.

NCST (?) I will send it tonight.

NCST (?) /

NCST (?) together, they give you travel and stay costs /

sysop (Coordinator) networking problems?

ULCC (?) Coordinator are u on dialup? /

Comsec (?) I hope that I am back on the bb

ULCC (?) Comsec ... u on dial-up and u Coordinator /

NCST (?) Comsec, did you read what I said? or shall I repeat the few lines ? /

Transcripts of Steering Group Meetings

Coordinator (?) Yes, I got thrown out but am back..no problems pls continue./

IIM (?) Who are you targeting and what will be the process of
IIM (?) nominations...over

sysop (ULCC) hmmm.. will go and have a look at the dial up.

NCST (?) IIM, we are now using the strategy of making the technical effort
NCST (?) a support activity for setting up real cooperation. So, I will ask you
NCST (?) for suggestions
NCST (?) of institutions worth contacting. For instance, the ones which sent
NCST (?) people to your workshop. But we will NOT take the same people,. but try
NCST (?) to target their
NCST (?) technical colleagues. /

Coordinator (?) I have rejoined via Coordinator's terminal
Coordinator (?) this is Comsec speaking as Coordinator
Coordinator (?) NCST - did you say that the costs are on the way (Comsec) over

IIM (?) There is a real danger of getting the wrong people unless you ask for

NCST (?) ok. Comsec did you read my answer to your question and IIM's ? /

Coordinator (?) Comsec: no

IIM (?) detail info about candidates .. over

NCST (?) yes. the cost info is on the way. you will get it today /

Coordinator (?) Comsec: ULCC - are you aware of the background to this?
Coordinator (?) over

NCST (?) as an action point, i will volunteer to produce a draft call for
NCST (?) workshop and a form to use for application. will Email it to IIM and
NCST (?) Comsec/Coordinator.
NCST (?) Is that OK ? I will ask the three of you for a list of places to send
NCST (?) the call /

Coordinator (?) Comsec: thanks
Coordinator (?) Comsec: ULCC - are your with us?

ULCC (?) yes ... sorry, answer to above question: no

Coordinator (?) Comsec: in essence, the proposal is that NCST runs a training programme,
Coordinator (?) with IIM, which will: 1. test out/pilot a how to join the network
Coordinator (?) pack; 2. act as a focus for like minded professionals working in
Coordinator (?) institutions with an interest in IT for development - hopefully
Coordinator (?) encouraging them to use the packs to form a functioning network of
Coordinator (?) researchers in the filed of IT for development
Coordinator (?) Comsec:
Coordinator (?) over

ULCC (?) sounds good anything I can help comment on, feel free

Transcripts of Steering Group Meetings

NCST (?) thanks for the summary to ULCC, Comsec. /

ULCC (?) to copy me /

NCST (?) I will mark a copy to you ULCC/

Coordinator (?) Comsec: We have provisionally put the funds in a safe place so we should

ULCC (?) thanks actually, I may be interested in this anyway

Coordinator (?) be able to proceed once we have the material as above

ULCC (?) we have some initiatives for local schools getting in /

Coordinator (?) Comsec: NCST - there are some issues which I hope you, IIM and Coordinator

Coordinator (?) could examine - I am particularly confused about the open debate on

Coordinator (?) administrative reform and a

Coordinator (?) atdl

Coordinator (?) Comsec: sorry we disappeared for a moment there

Coordinator (?) I was saying that I was confused about the open bulletin board

Coordinator (?) discussion that is to precede the training programme

Coordinator (?) I am also concerned to ensure that the pack is relevant for Africa

Coordinator (?) which will be its main market - hence the suggestion that MJ

Coordinator (?) gets involved

Coordinator (?) Comsec: over

NCST (?) taking your second question first

NCST (?) there is a very fine piece of software - waffle - that a few nodes are

NCST (?) now using in India -

NCST (?) it is in the public domain , so free of charge - does not need Unix

NCST (?) runs on MS-DOS PC compatibles

NCST (?) AND SUPPORTS MULTIPLE USERS.

Coordinator (?) ha

Coordinator (?) sorry - I didn't mean to laugh

NCST (?) IF YOU USE good external modems (must be 150 US dollars each)

NCST (?) will work on any telephone network you can use for voice communication /

Coordinator (?) Have you hear of snum - produced at the univ of SA also public domain

Coordinator (?) and free of charge?

Coordinator (?) hi

NCST (?) are you typing over ? or forgot ? /

Coordinator (?) we disappeared again for a minute..

Coordinator (?) Comsec: please repeat the last point /

NCST (?) I have not heard of snum. will be happy to try it /

Coordinator (?) Comsec : my point is that it will be hard to ensure that we have an

Coordinator (?) appropriate pack for a region where the circumstances and expectations are

Coordinator (?) very different

Transcripts of Steering Group Meetings

NCST (?) I understand your worry. I was saying

Coordinator (?) hence my concern to ensure that the pack is 'grounded' in local

Coordinator (?) realities

Coordinator (?) /

NCST (?) that a very good pack exists and is sure to work well over poor

NCST (?) telephone

NCST (?) networks /

NCST (?) /

NCST (?) cooperating with MJ is something we can surely look at . /

Coordinator (?) how else could we try it in Africa?/

NCST (?) but i do believe that waffle and an external modem will work anywhere /

NCST (?) I would suggest helping a University in Africa to make contact. Actually

NCST (?) over 30 locations

NCST (?) in Africa have Email contact with the world already. I can furnish a

NCST (?) list /

Coordinator (?) Comsec: we have some lists (I do not know if they are as current as

Coordinator (?) yours) but I am still concerned that African experiences inform the

Coordinator (?) development of the pack/

Coordinator (?) shall we agree in principle that MJ or someone appropriate from Africa

NCST (?) okay. /

Coordinator (?) should get involved in some of the planning?/

Coordinator (?) Comsec; next item

Coordinator (?) ULCC - could you update us about the X500 debate - I understand that the

Coordinator (?) Commonwealth is now an organisation on the top level/

ULCC (?) well not yet, but that is the current proposal, i.e. put

ULCC (?) O=Commonwealth under the world root

Coordinator (?) Comsec: Assuming that this gets somewhere, the question is how we ensure

SYSTEM:Wed Oct 27 15:01: Another hour passes....

Coordinator (?) that there are some worthwhile entries for Commonwealth countries

Coordinator (?) what is happening generally to get people's names and details on the

Coordinator (?) system?/

ULCC (?) now we've got a structure we can add what we have will coordinate

ULCC (?) with Coordinator on this

ULCC (?) the structure is still tentative but

ULCC (?) don't want to spend long debating it still within the

Coordinator (?) Comsec: ULCC- who is responsible for encouraging email users to come

Coordinator (?) forward and register (or whatever the term should be) as entries in the

ULCC (?) X500 world circles ... it's opened up quite a debate, this structure

Transcripts of Steering Group Meetings

Coordinator (?) X500 directory?/

NCST (?) I will volunteer that NCST will maintain a list for India -

ULCC (?) OK thanks

NCST (?) we can do some promotion and add/delete names at users request. users

NCST (?) should use Email

NCST (?) to send in requests /

ULCC (?) that's actually a problem area, getting those countries existing

ULCC (?) in the directory tree to put in org's for the COMNET-IT initiative.

ULCC (?) but not a big problem with our contacts/

Coordinator (?) Comsec: ULCC, isn't the main problem just to get entries of any sort - if

Coordinator (?) Commonwealth is an organisation at the highest level, then surely the

Coordinator (?) system will sort entries by such organisations and so will pull out all

Coordinator (?) Commonwealth entries under appropriate headings?/

ULCC (?) yes the public interface on the world root here

ULCC (?) will indeed do this ok/

Coordinator (?) hi

Coordinator (?) Comsec: sorry we disappeared again for a moment

Coordinator (?) Comsec: I think that it is because I type too quickly

Coordinator (?) Comsec: ULCC, I was asking if the X500 system will sort by organisation -

Coordinator (?) if so, the entries don't need to be specific to COMNET-IT - just entered

Coordinator (?) under Commonwealth country headings?/

ULCC (?) yes will do that too.

ULCC (?) /

Coordinator (?) ULCC- could you keep us all informed of the X500 developments - and let

Coordinator (?) us know what we could do at country level?

Coordinator (?) /

ULCC (?) yes ...

Coordinator (?) thanks next item

ULCC (?) I'm still really working out

ULCC (?) the structure

ULCC (?) but this should not stop

ULCC (?) us now adding the data since

ULCC (?) the basis org is now there in place /

Coordinator (?) extending the newsletter circulation

Coordinator (?) Comsec: Any thoughts as to how we can extend the mailing list for the

Coordinator (?) COMNET/IFIP newsletter?/

ULCC (?) Just a thought about email lists ... when you're ready? /

IIM (?) We mail to about 500 now.. over

Transcripts of Steering Group Meetings

ULCC (?) please mail me for now
ULCC (?) /

NCST (?) i have a suggestion in extending reach of newsletter
NCST (?) there is a Usenet group, I think named comp.development,
NCST (?) we can see if the whole newsletter can be posted on it. the newsgroup is
NCST (?) languishing with no postings. we might revive it and make use of it /

Coordinator (?) That does sound like a very good idea - by the way Comsec has just been
Coordinator (?) summoned to his next meeting and send his apologies
Coordinator (?) please do go on /

IIM (?) We can disseminate it electronically but the printed version reaches out

Coordinator (?) That is very true

NCST (?) of course, we should keep printing the hardcopy. but use

Coordinator (?) it would be a good idea to introduce the ICGITD members to IFIP if that

NCST (?) comp.development in addition/

Coordinator (?) is alright with you /
Coordinator (?) If you recall COMNET-IT is providing ICGITD with some administrative
Coordinator (?) services
Coordinator (?) /

ULCC (?) Coordinator, have you access to this usenet news?

Coordinator (?) No
Coordinator (?) /

NCST (?) what is icgitd ? /

Coordinator (?) The Informal Consultative Group of Information technology for
Coordinator (?) Development - the group that was founded at the January conference
Coordinator (?) remember ?

NCST (?) I do, very much /

Coordinator (?) hi /

NCST (?) hi /

Coordinator (?) things disappeared again - could you please repeat the last line /

ULCC (?) I think Coordinator's modem connection keeps going into retrain
ULCC (?) I think they must have some of those poor telephone

Coordinator (?) The screen gets stuck when I type fast /

NCST (?) ii said " I do remember ICGITD, very much" /

Transcripts of Steering Group Meetings

ULCC (?) lines in their end on London :-)

Coordinator (?) True/

Coordinator (?) Shall we proceed to the next item : Governet ?

Coordinator (?) /

NCST (?) just a mo /

NCST (?) it may be useful to call MJ to give you some developing country

NCST (?) software (-) fro use in London /

ULCC (?) yes ... good point :-)

Coordinator (?) That's right would you like his phone no NCST ? /

NCST (?) yes. pls Coordinator. actually his address,

Coordinator (?) Oh yes - true !

ULCC (?) Com Sec office could be a good test site !!

NCST (?) email address and phone no.

NCST (?) you might have sent it to me earlier,

Coordinator (?) Yep - developing country it is

NCST (?) but I will need to search. if you have it handy pls email /

Coordinator (?) we are very familiar with those problems../

ULCC (?) I'll stick it in dir /

Coordinator (?) No problem I have it right here: 27 - 11-484-3557 (fax)

NCST (?) thanks /

Coordinator (?) 27-11-614-8231, hiltrow Johannesburg

Coordinator (?) / no problem

ULCC (?) email ? /

NCST (?) pls confirm name is MJ /

Coordinator (?) yes: MJ, email: mikej@gn.apc.org or

ULCC (?) would he be the "task force" leader for the S.African Region?

ULCC (?) or something else? /

Coordinator (?) worknet address: mj@wn.apc.org

ULCC (?) no i haven't

Coordinator (?) ULCC: We are considering both CM and MJ

Coordinator (?) I shall send you both of their cvs

Transcripts of Steering Group Meetings

ULCC (?) OK that'll be easiest /

Coordinator (?) Since MJ has an Internet connection that is direct
Coordinator (?) he appears to be more reachable - however, CM is African
Coordinator (?) and Comsec is very keen on getting him on the task force too - so it
Coordinator (?) really will be decided after all of you have had a look at their cvs and
Coordinator (?) we have had a chance to try them out /

ULCC (?) OK /

Coordinator (?) IIM, NCST any thoughts ?

NCST (?) I have a question. do we have to choose between them ? /

Coordinator (?) No not really:

ULCC (?) then why not both, if willing ?/

Coordinator (?) CM operates a very successful node whereas MJ travels to
Coordinator (?) sites in sub-saharan africa providing training and technical assistance
Coordinator (?) I am trying to get at least one of them connected to the Bulletin board

ULCC (?) both sound valuable /

Coordinator (?) so that all of us can communicate with regard to governet/

ULCC (?) should I add them to the comnet-it e-mail list ? /

Coordinator (?) I can pass on their details to you but I still have to find out their
Coordinator (?) exact affiliations, this I think you will find when I send out their
Coordinator (?) cvs. /

ULCC (?) OK ... I'll hold on this until I hear further /

Coordinator (?) I shall keep you informed /
Coordinator (?) May I proceed to Governet now ?

ULCC (?) y /

NCST (?) one moment
NCST (?) have we, therefore, , decided to have both of them on
NCST (?) the steering committee ? /

Coordinator (?) I believe so ... any objections ?/

NCST (?) I am in favour of the proposal /

Coordinator (?) IIM ?

NCST (?) IIM, are you there ? /

Coordinator (?) I think that he has left us

Transcripts of Steering Group Meetings

ULCC (:) sorry ... /

NCST (?) let us go, ahead, Coordinator. Let us note that there is no
NCST (?) objection to having both on the steering committee /

ULCC (?) agreed/

NCST (?) now to Governet //

Coordinator (?) Great.

Coordinator (?) To summarise briefly, we are in the process of linking up the management

Coordinator (?) development institutions in Africa using NCST's training programme and

Coordinator (?) How to Join the network pack. In order to be effective this has to be

Coordinator (?) done in conjunction with people who are familiar with the African scene

Coordinator (?) We are in the process of obtaining funds for this. the EEC appears to be

Coordinator (?) very keen on funding this but require a lot of information -

Coordinator (?) particularly on the feasibility of the project before the begin to dish

Coordinator (?) out the required funds.

Coordinator (?) /

NCST (?) do you mean the

Coordinator (?) At the moment we need to explore as many possibilities as there may be

NCST (?) training programme (the March workshop ?) /

Coordinator (?) for funding this initiative. Would nay one have any ideas ?

Coordinator (?) NCST: we hope to send MJ to the March training workshop.

Coordinator (?) /

NCST (?) are there any Indian rupees available from the Indian govt for

NCST (?) commonwealth activities ? /

Coordinator (?) I have to find out. But for the moment we have frozen some commonwealth

NCST (?) I would welcome MJ's coming.

Coordinator (?) funds for the March workshop /

NCST (?) But it may be worth discussing if we want him here all through the three

NCST (?) weeks.

NCST (?) A part would be sufficient I think /

Coordinator (?) That sounds like a good idea. He is technically proficient but needs to

NCST (?) You mentioned

NCST (?) EEC funding. What activity was this meant for ? /

Coordinator (?) learn about piloting your training pack and developing it with you /

NCST (?) OK.

NCST (?) /

Transcripts of Steering Group Meetings

Coordinator (?) The initial funds from the EEC will be about 50-100. hi, sorry got stuck

Coordinator (?) again

Coordinator (?) these will cover the feasibility and initial costs of getting experts

Coordinator (?) out into the field. Hopefully we should also be able to manage some

Coordinator (?) training in this amount. But we do need to supplement this later on /

Coordinator (?) any thoughts ?

Coordinator (?) /

ULCC (?) Coordinator I think you have a "flow control" prob

NCST (?) did you say 50 to 100 ECU s ? /

ULCC (?) try and keep lines short for now ... sorry to butt in/

Coordinator (?) Sorry: I mean 50 - 100 thousand pounds,

Coordinator (?) Thanks ULCC- I shall do that /

NCST (?) ok /

NCST (?) i think it is a good sign that EEC is putting some money into this /

Coordinator (?) I hope that it comes through - still we have to have back-up plans like

ULCC (?) yes that is encouraging ... /

Coordinator (?) working with PADIS /

Coordinator (?) Any thoughts on additional funding ?

Coordinator (?) If not, then I shall move on to the last item

Coordinator (?) if that is alright be you /

ULCC (?) y /

NCST (?) y/

Coordinator (?) On last thing that has just come up is that the

NCST (?) just a mo /

NCST (?) go ahead Coordinator /

Coordinator (?) Management Systems Unit in Malta - a corporatised

Coordinator (?) arm of the Maltese government

Coordinator (?) are very keen to collaborate with

Coordinator (?) COMNET-IT. Any thoughts on what they may be able to do ?

Coordinator (?) Administrative help perhaps ? /

NCST (?) admin help seems too little to ask /

Coordinator (?) Yes, you are right

NCST (?) cant they be a node on COMNET and do useful work in their region ? /

Coordinator (?) What sort of work ?

Coordinator (?) /

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NCST (?) publicising.

NCST (?) organising a workshop or conference. /

NCST (?) I have a feeling that we have to invent

Coordinator (?) Well, they are very much into management consultancy and information

Coordinator (?) technology

NCST (?) a form of low cost conference mostly depending on local talent and

NCST (?) know how. /

ULCC (Coordinator) is Malta a commonwealth country?

Coordinator (?) The Maltese are part of the Commonwealth

ULCC (?) ta

Coordinator (?) They are very well into electronic networking and appear to be very

NCST (?) what is "ta" ULCC? /

Coordinator (?) technically proficient /

Coordinator (?) Sorry : didn't mean to interrupt ULCC/

NCST (?) good. we can surely keep them on the mailing list and ask

NCST (?) them to link up via datacom. the rest will

NCST (?) automatically develop

NCST (?) out of their willingness to

NCST (?) do something. //

Wed Oct 27 16:00:08 1993

Coordinator (?) Shall we add them to the COMNET/IFIP newsletter mailing ?

Coordinator (?) /

ULCC (?) sorry ... ta = thankyou, it's poor form of English! /

NCST (?) of course, yes /

NCST (?) I meant to reply to Coordinator. Thanks, ULCC.

Coordinator (?) Comsec has had

Coordinator (?) conversations with the Chairman of MSU - JT

Coordinator (?) who is willing to provide some sort of

Coordinator (?) organisational base' for COMNET

Coordinator (?) We don't know how to work this out as yet

Coordinator (?) any thoughts /

NCST (?) ok /

Coordinator (?) I mean what can they have an organisational base

Coordinator (?) for ?

ULCC (?) !

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Coordinator (?) What can COMNET-IT ask them to administer ?

ULCC (?) sorry finger slipped.

Coordinator (?) Does this make any sense ? /

Coordinator (?) ok /

NCST (?) I don't see anything substantive enough for MSU to do at this moment. /

ULCC (sysop) hi there

Coordinator (?) True.

Coordinator (?) Any ideas from ULCC?

Coordinator (?) /

sysop (jas) hi there :)

ULCC (?) no just watching here with interest, thanks /

Coordinator (?) I think that at

sysop (Coordinator) thanks for waking me..

Coordinator (?) this stage we can wrap up the discussion

ULCC (sysop) just playing, I actually said tell ULCC but it told U!

Coordinator (?) basic

sysop (ULCC) if you do it to yourself it says: You mumble to yourself.

ULCC (sysop) getting bored! thanks

Coordinator (?) hi there - got thrown out again

sysop (ULCC) the conversation seems to have dried up some what..

Coordinator (?) We were wrapping up:

ULCC (?) yes Coordinator, any chance you being able to ring me without logging

ULCC (?) out so we can look at the flow control prob /

Coordinator (?) At the moment no, because I am using my phone line

Coordinator (?) for this session. /

ULCC (?) OK just a thought/

Coordinator (?) Thanks anyway /

sysop (?) what sort of flow control are you using Coordinator? /

Coordinator (?) Dunno

Transcripts of Steering Group Meetings

NCST (?) Coordinator,
NCST (?) I assume that a file copy is

Coordinator (?) Speed is 1200 /

ULCC (?) speak on phone would be best /

NCST (?) available. So, ULCC can mail it to each of us.

Coordinator (?) Yes, there is a file copy
Coordinator (?) If the .record command works than I may have

NCST (?) Perhaps, one of us can extract the action points , if it is necessary,
NCST (?) and
NCST (?) send it around so that each one knows
NCST (?) what he/she has committed to /

Coordinator (?) Yes.
Coordinator (?) I was going to summarise by saying that:

NCST (?) ULCC. If we have completed the conference, then you can
NCST (?) talk on this line and help Coordinator solve the flow
NCST (?) control problem.,
NCST (?) I have
NCST (?) only one question, if the conf is over .
NCST (?) /

Coordinator (?) Yes, the conference is over.
Coordinator (?) we have discussed all the items on the agenda.
Coordinator (?) /

NCST (?) Is M at the office. ? Or is he on leave ?
NCST (?) /

Coordinator (?) I don't know - I haven't seen him around lately.
Coordinator (?) /
Coordinator (?) You can always try calling his office /

NCST (?) OK. I will drop off then. Good to talk to both of you.
NCST (?) My apologies for the initial problem I had.

Coordinator (?) I must go now. there is someone waiting here.

NCST (?) ULCC, how do exit the talk and go to
NCST (?) shell level on clus1. I want to set my password.
NCST (?) /

Coordinator (?) Good to see you , bye.

NCST (?) bye Coordinator /

sysop (?) NCST> you can't set the password from here.. I'll get JD to

Transcripts of Steering Group Meetings

ULCC (?) ok ... sorry got a phone call thanks

ULCC (?) and bye to all

sysop (?) change it to something more secure and he will let you know what it is

sysop (?) /

NCST (?) bye ULCC. /

sysop (?) actually I could change it for you...

sysop (?) hold on a moment

NCST (?) Sysop, Many thanks. So JD will set a new password for me. Did

NCST (?) you say ?

NCST (?) /

NCST (?) OK. If you can change it , pls do and tell me the new password. /

sysop (?) can't change it - it has to be done from root

sysop (?) I'll get JD to do it..

NCST (?) OK. Then may be you can do it later or ask JD to change it for me.

NCST (?) pls Email me the new password. to my address

sysop (?) which address would u like it emailed too?

NCST (?) NCST@saathi.ncst.ernet.in

sysop (?) ok - I'll do that for you.

NCST (?) Many thanks, Sysop. I will drop off now.

NCST (?) /

NCST (?) bye/

sysop (:) waves goodbye

NCST (?) bye ULCC/

ULCC (?) bye

Transcripts of Steering Group Meetings

Third Steering Group Meeting on Thursday 27th January 1994 at 10 am GMT

Comsec (?) anyone there?

sysop (?) hi

Comsec (") am I shouting?

sysop (?) yes

Comsec (?) how do I get into shout mode - that was just a single shout

sysop (?) do "

Comsec (?) do what?

sysop (?) do a ""

sysop (:) a "

Comsec (") @

Comsec (") I understand - thanks?

Comsec (?) is ULCC going to join us?

sysop (?) I don't think ULCC is in yet.. He should be in around 10

Comsec (?) Coordinator - is this set to record and print what we discuss?

sysop (?) yes - anything that is said on the talker or via send messages is

sysop (?) automatically recorded in the logs.

Comsec (?) what about the talk facility - we had some discussion about the need to

Comsec (?) be able to say more than one line - I can't remember what the outcome

Comsec (?) was.

sysop (?) Well - I had a go at trying to do code that in - but I can't see how it

sysop (?) can be done. I have had a word with the guy who wrote it and he will

sysop (?) see what he can do.

sysop (?) Unfortunately he is a little snowed under with work so it may be a little

sysop (?) while. There is also the slight problem that we haven't actually paid

Coordinator (?) does, the record command work now ?

sysop (?) for this and the trial period was over ages ago.

Comsec (?) do you mean that Commonwealth Secretariat hasn't

Coordinator (?) at

sysop (?) the .record command still doesn't work - same situation as the longer

sysop (?) lines

Coordinator (?) hi sysop

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sysop (?) hello

Coordinator (?) is ULCC in at all ?

sysop (?) nope

Coordinator (?) hope he hasn't forgotten

sysop (?) I'll remind him as soon as he gets in. :)

Coordinator (?) thanks

Coordinator (?) does the record command work now ?

Thu Jan 27 10:00:09 1994

SYSTEM:Thu Jan 27 10:00: Another hour passes....

sysop (?) no - same situation as the longer lines in talker.

Coordinator (?) oh well, I think we can survive, did you get

Coordinator (?) a chance to play with IRC

Coordinator (?) ?

sysop (?) no - I haven't had a chance to compile it yet. I have had a play with

Comsec (?) I was shut out - is anyone still there?

sysop (?) an IRC server in the states though.

Coordinator (?) is it any good ? Hi Comsec !

sysop (?) well, it isn't very user friendly...

Coordinator (?) no better than the talker ?

sysop (?) it was also fairly slow - but that was due to the distance and the

sysop (?) amount of people connected at the time.

sysop (?) well it has a lot more commands than this talker but I think it may be a

Coordinator (?) it is a public utility isn't it ?

sysop (?) little daunting for most people

Comsec (?) I don't know what you are talking about but I am going to keep sending

sysop (?) I think it is a public utility - yes

Comsec (?) messages in case it shuts me out again

sysop (?) I think the network was the cause of you getting shut out..

Coordinator (?) Great idea Comsec .!

sysop (?) It also happened to me - and I am sitting next to mhs-relay.

Transcripts of Steering Group Meetings

Coordinator (?) What is wrong with it ?

sysop (?) nothing now - just a little 'glitch'.

Coordinator (?) I'll just go and check for the others..

Comsec (?) JF is sitting with me and I am showing him the exciting

Comsec (?) features of the bb

Comsec (?) welcome back Coordinator - where are the others?

Coordinator (?) IIM has just logged in..but no sign of the others

Coordinator (?) MJ did say he was having trouble with the logging onto

Coordinator (?) the BB

sysop (?) what problems is he having?

Comsec (?) Coordinator - how do you know that IIM has logged on - JF is

Comsec (?) curious

Comsec (?) (in many ways!)

Coordinator (?) Well, he is trying to logon from South Africa - apparently he

Coordinator (?) just recently got an Internet connection.

Coordinator (?) I went into 'Users on Monochrome' to see who is logged on - some info

Coordinator (?) for the curious

sysop (?) you can also do a .who from within talker to see who is connected

sysop (?) connected even.

Coordinator (?) cool..

sysop (?) just moving terminals - back in a moment.

Coordinator (?) Comsec, shall I give MJ and ULCC a ring ?

Comsec (?) yes

Comsec (?) hi IIM - how are you?

IIM (?) Hi I have joined.

IIM (?) What are you guys discussing

Comsec (?) IIM - so far we have just been trying to keep in the system - which

Comsec (?) keeps trying to evict us

Comsec (?) the meeting is rather sparsely attended so far also

Comsec (?) no sign of ULCC, NCST, or MJ

sysop (?) ULCC has just walked into his office - I'll just go and remind him

IIM (?) NCST may not join as he is in Delhi

IIM (?) Has Coordinator made arrangements to be in Cuba

Comsec (?) yes - she should be around somewhere

sysop (?) ULCC will be on shortly.

Transcripts of Steering Group Meetings

Comsec (?) Coordinator - are you there?

IIM (?) I have posted the Jan issue of the newsletter to her yesterday

IIM (?) I have also included the ones to be distributed at LSE

Comsec (?) we will start as soon as ULCC joins us

IIM (?) Meanwhile I must remind you that my telephone bill for the last

Coordinator (?) Hi ULCC

IIM (?) conference is still unpaid

Comsec (?) IIM - sorry about that - I thought that a IMO had been sent - I will

Comsec (?) investigate

Coordinator (?) Thank you IIM

Coordinator (?) Please send us the invoice

Coordinator (?) for the last meeting

Coordinator (?) (phone bill)

Coordinator (?) /

Comsec (?) Sysop - has ULCC got his coffee yet?

IIM (?) I will send for last and this one together.

Coordinator (?) Thanks

sysop (:) grins - I think he was trying to drink it when I phoned him just now.

sysop (?) Coordinator > have you had a chance to test the commdemo account?

IIM (?) I will need to leave by 4:45 IST(11:15 GMT)

Comsec (?) OK lets start - this will necessarily be a brief meeting as we are so

Comsec (?) few

Comsec (?) ULCC is on his way - and will catch up when he joins

Comsec (?) we must assume that NCST is not able to join us, and that MJ

Comsec (?) could not get the connection

Comsec (?) the first item concerns the constitution

Comsec (?) my feeling is that we need to consider changing the constitution to

Comsec (?) reflect the reality that COMNET-IT is a collection of activities rather

Comsec (?) than a membership-based organisation

Comsec (?) we discussed this briefly last time - and I said that I would do some

Comsec (?) work on it - I delayed taking any action as there is a possibility that

Comsec (?) Malta (i.e. government of) will provide an institutional base for COMNET

Comsec (?) - with facilities and administrative support - and it seemed sensible to

Comsec (?) wait until this is clear before we decide what sort of legal entity it

Comsec (?) should be

Comsec (?) any comments? - over

ULCC (?) hi ... sorry late, British Rail would like to apologies for

ULCC (?) the inconvenience ... etc. etc. etc.

Transcripts of Steering Group Meetings

IIM (?) That seems fine so what do we have to decide on for now

Comsec (?) nothing - but we need to acknowledge that we are living with some
Comsec (?) organisational awkwardness i that we are legally constituted a
Comsec (?) membership-based organisation - but we have no members!
Comsec (?) over

Coordinator (?) but we have participants
Coordinator (?) over

IIM (?) I think it is much better that an activity pattern evolves and we
IIM (?) formulate a suitable organisation pattern to carry them out rather than
IIM (?) vice versa

Comsec (?) ULCC - any thoughts? - over
Comsec (?) ULCC - are you there?
Comsec (?) Sysop - have we lost ULCC?

sysop (?) Not sure as I am not in the same office.

Comsec (?) OK - lets move on to the next item

IIM (?) We have an agenda item on new members. Should we take the 2 items
IIM (?) together

Comsec (?) IIM - you had views about MJ and CM
Comsec (?) do you want to expand?
Comsec (?) over

IIM (?) Yes I had sent a note.

Comsec (?) I take your point that CM does not have a particularly high profile
Comsec (?) in networking terms - but there are other considerations

ULCC (?) ah .. its one of those days knocked the "screen hold"

Comsec (?) not the least being that we do not have an indigenous African involved

ULCC (?) button and I've been "flowed controlled" just catching up

Comsec (?) and this could be of some significance in terms of our presentation
Comsec (?) over

IIM (?) Then it is OK by me, but I think we need to define membership at multiple
IIM (?) levels over

Coordinator (?) Perhaps - that CM should be part of
Coordinator (?) that African - Management Dev Task force
Coordinator (?) That MJ is being involved in ?
Coordinator (?) over

IIM (?) That may be quite appropriate

Transcripts of Steering Group Meetings

Comsec (?) there might also be a need to involve someone from Malta - the part of Comsec (?) government that is interested in hosting COMNET is called MSU - they are Comsec (?) a fully owned government company responsible for providing management Comsec (?) consultancy and IT support to the Maltese public sector

IIM (?) Certainly. We have had a participant from Malta in the COMSEC course I

Comsec (?) the managing director is coming to London in a week or so and so I could

IIM (?) will send you his details.

Comsec (?) find out the technical capacity of their people - at face value they Comsec (?) seem pretty impressive - over

Coordinator (?) From what I understand, the Maltese may be in a very good

IIM (?) I got the same impression that they are generally ahead of several DC's

Coordinator (?) position to provide some administrative support over
Coordinator (?) over.

ULCC (?) just looking at network details for Malta
ULCC (?) seems we have email connection to them, country code is MT.

Comsec (?) OK - I will report back when I have met the MD of MSU
Comsec (?) before we move to the next item - the Bombay workshop - I thought that Comsec (?) it might be useful if I quickly run through a list of current COMNET-IT Comsec (?) activities - just so that we are up to date with recent developments - Comsec (?) is that OK? - over

Coordinator (?) yes - over

ULCC (?) yes ... ta.

IIM (?) OK that would be nice over

Comsec (?) OK - first is the GOVERNMENT project - which looks like it is gaining Comsec (?) some momentum
Comsec (?) this is the project to develop a cheap and cheerful network for the Comsec (?) management development institutions in eastern and southern Africa
Comsec (?) the pack which we hope will emerge from the Bombay workshop will form Comsec (?) a key component of this network - if NCST is correct in his Comsec (?) predictions, the pack tested at the workshop will contain a modem, Comsec (?) software and supporting literature appropriate for the local conditions
Comsec (?) obtaining MJ's input into the workshop will ensure that it is Comsec (?) suitable for the local environment
Comsec (?) the GOVERNMENT project is attracting a lot of interest - as yet no funding Comsec (?) although we keep being told that the EC is interested - and now we Comsec (?) hear that the World Bank is interested in developing it into a very Comsec (?) large scale project
Comsec (?) while all these debates go on, we are assuming that we must keep it Comsec (?) going with Commonwealth Secretariat funding and I am seeking sufficient funds to undertake Comsec (?) the feasibility study, to distribute some packs, and to buy into the

Transcripts of Steering Group Meetings

Comsec (?) PADIS training to make sure that there are sysops at each location
Comsec (?) next project is the Bombay workshop itself - we need to talk about that
Comsec (?) in more detail in a moment
Comsec (?) then there is the newsletter - IDRC and the Commonwealth Secretariat are putting significant
Comsec (?) and less significant funding into this (respectively)
Comsec (?) then there is the Informal Consultative Group for Information Technology
Comsec (?) |for development (ICGITD)
Comsec (?) this ridiculous acronym resulted from a London workshop which suggested
Comsec (?) that there was a need for interested personnel in development agencies,
Comsec (?) and key national experts, to have a facility to discuss IT funding
Comsec (?) issues and development policies on an informal basis
Comsec (?) it looks as if COMNET_IT will get some CIDA funding (not much - but
Comsec (?) enough) to run with this for a while
Comsec (?) basically it will simply be a question of developing an interest group
Comsec (?) from the big development agencies, and appropriately placed national
Comsec (?) experts - and getting them together for structured discussions
Comsec (?) to give their discussions some content, COMNET will collate all the

IIM (?) I am involved with the Program Committee of the IFIP world Congress to

Comsec (?) national and regional newsletters on IT for development (of which the
Comsec (?) COMNET/IFIP is the leading example) and send packs of all the
Comsec (?) newsletters to all the members
Comsec (?) finally (Coordinator remind me if I have missed out anything) there is the

IIM (?) be held in August in Hamburg. It focuses on communications. Would

Comsec (?) plan to re-launch the journal IT for Development
Comsec (?) we are just about to commission MO to undertake a

IIM (?) COMNET-IT like to make a presentation on its efforts to promote

Comsec (?) feasibility study to look at the offer from IS press to put some money
Comsec (?) into this venture
Comsec (?) I think that is all the current activities - over for any questions
Comsec (?) or comments

Coordinator (?) That sounds very clear -
Coordinator (?) I think that IIM is trying to comments
Coordinator (?) over

ULCC (?) our facilities here are available to Commonwealth Secretariat as usual as best we can
ULCC (?) provide ...

Coordinator (?) Including IT development ?
Coordinator (?) over

Comsec (?) IIM - at face value - yes - please let us have more details of the
Comsec (?) Hamburg event

ULCC (?) for experimental/piloting etc, I guess so.

Comsec (?) OK - I am keen to move on - I would like to finish by 11.15 GMT (for my

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IIM (?) I will in a separate message. Please see the Jan news letter over

Comsec (?) own sake as well as for IIM's

Comsec (?) can we spend a few moments on the Bombay workshop

Comsec (?) I covered this in my review of activities above - but there is one point

Comsec (?) I am not clear about myself - IIM - are you going to the workshop,

Coordinator (?) it would also be good to discuss the Network of Research

Coordinator (?) Institutions

Coordinator (?) over

Comsec (?) and have you and NCST had an opportunity to strategise about the

Comsec (?) possibility of a network of research institutions being developed from

Comsec (?) the participants? - over

IIM (?) Yes I am planning to because I had committed to NCST.

Comsec (?) great

Coordinator (?) Have you received the brochures - IIM

Comsec (?) I am hoping that in the margins of the workshop lots of other points can

Comsec (?) get discussed - NCST, IIM, Coordinator, MJ and R should

IIM (?) Do you need any help in promoting it

Comsec (?) all be there - so issues about taking GOVERNET forward technically and

Comsec (?) financially, and about the network of research institutions, can get

Comsec (?) covered - as well as points around marketing the 'how to join the

Comsec (?) network' pack

Comsec (?) any other points about the Bombay workshop? - over

Comsec (?) IIM - R is handling that and I don't really know - I will ask

Comsec (?) him to let you know if we do need more help - Coordinator, do you know if it

Coordinator (?) I just wanted to know if IIM

Comsec (?) needs more promotion? - over

Coordinator (?) had received the brochures

Coordinator (?) As for promoting the workshop - well, the brochures have

IIM (?) R will be in Ahmedabad in Feb?

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Coordinator (?) been sent to all heads of civil service (I believe he will be)

Coordinator (?) and some 'hand picked' resource persons - as R calls them.

Comsec (?) IIM - I will ask R to let you know 1. if he needs any further

IIM (?) I don't need more brochures but I can supply an address list for mailing

IIM (?) to R

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Coordinator (?) Fine
Coordinator (?) over

Comsec (?) assistance and 2. if he will be coming through Ahmedabad

ULCC (?) would this list be useful to go into the directory?

Comsec (?) OK lets move on quickly to the newsletter

IIM (?) Yes it could.

Comsec (?) IIM - where are we at in terms of extending the circulation - what
Comsec (?) should we be doing to help?
Comsec (?) over

IIM (?) The last issue is still at 550. If we sort out the funding with IDRC
IIM (?) then in April we would move to a 1000. We need to start compiling the
IIM (?) list. over

Comsec (?) did we send you a list of civil service contacts? - they might be useful
Comsec (?) on a short term basis - i.e. that newsletters are sent for one or two
Comsec (?) editions and then they have to confirm that they are interested - or

IIM (?) No I would very much like the list but I hope these are different from

Comsec (?) suggest a mor relevant name - what do you think? - over

IIM (?) your POC's over

Comsec (?) yes - they are very different!!!!!! - over

IIM (?) Please send the list

Comsec (?) OK
Comsec (?) the final 2 items on the agenda have more or less been covered -

IIM (?) We are planning a 24 page issue from April and possibly a section of

Comsec (?) GOVERNET is a complicated project, and we need to reflect on the
Comsec (?) possibilities when we have heard back from MJ - it was a shame
Comsec (?) that he could not be with us today

IIM (?) refereed articles.

Comsec (?) the MSU Malta connection offers a real possibility of getting
Comsec (?) significant administrative and technical support for a COMNET-IT HQ -
Comsec (?) but we will only know the real chances of anything emerging from a very
Comsec (?) tentative proposal in a few weeks
Comsec (?) so - I suggest that we leave it at that for the time being - any final
Comsec (?) thoughts

NCST (?) NCST here. i hope you are there

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IIM (?) Bye

Coordinator (?) Hi NCST - glad you could make it

ULCC (?) hi

Comsec (?) NCST - we were just finishing!!

NCST (?) greetings to everyone. my link is of poor quality
NCST (?) i am not be able to stay for any length of time.

Comsec (?) NCST - sorry to welcome you and then leave you, but I must go. Coordinator

NCST (?) if there is anything we can finish in a few minutes, pls do tell me.

Comsec (?) - could you arrange for everyone to be e-mailed with the transcript of
Comsec (?) the discussions this morning (London time)

Coordinator (?) The COMNET-IT workshop - NCST
Coordinator (?) over

NCST (?) hi Coordinator

Coordinator (?) Did you get a chance to look at the revised version of the
Coordinator (?) Programme ? NCST - Hi
Coordinator (?) over

NCST (?) did you send it by email ?

Comsec (?) ULCC, NCST, Coordinator - I must leave you. Next time we must be more
Comsec (?) disciplined about starting and finishing!
Comsec (?) speak to you all soon
Comsec (?) bye

Coordinator (?) Yes, and fax and the brochures should have arrived to you
Coordinator (?) by now.

ULCC (?) my fault I was delayed and late and rushed.

Coordinator (?) Bye Comsec !

ULCC (?) apologies

Coordinator (?) over

NCST (?) i quite agree Comsec. my apologies, i was stuck in delhi and i am still in
NCST (?) delhi
NCST (?) Coordinator, i got the printed brochure/

Coordinator (?) Are you happy with the programme ?
Coordinator (?) We are trying to get MJ to arrive
Coordinator (?) a few days before to help work on the 'how to join the
Coordinator (?) network ' pack

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Coordinator (?) over

NCST (?) I have seen the programme.

NCST (?) broadly the programme with two way parallelism is fine

NCST (?) exactly how many sessions will be common and how many

NCST (?) without parallelism will need to be worked out. we will do that and send

NCST (?) you

Coordinator (?) I think this also depends on the nature of the participants

NCST (?) our proposal. MJ is welcome a few days in advance.

NCST (?) /

ULCC (?) qqqq

Coordinator (?) don't you think ?

Coordinator (?) Thank you, R will be passing by to speak to you about

Coordinator (?) the technicalities,

Coordinator (?) as for the starter pack, do you think that there will be

Coordinator (?) something at the end of the workshop to take away ?

Coordinator (?) over

NCST (?) yes. i got rogers fax. i don't if he will be reading the reply i faxed

NCST (?) immediately

NCST (?) i

Coordinator (?) yes, he is not around at the moment.

Coordinator (?) over

ULCC (?) no body but us left ... what is the African IT Forum?

ULCC (?) They have sent me brochures for a conference in sept at

ULCC (?) Oxford Uni.

Coordinator (?) Did you read it in AITEC ?

ULCC (?) They did one in London in Sept last but I could go ..?

ULCC (?) yes AITEC is "the event"

Coordinator (?) Yes, AITEC organise these commercial

Coordinator (?) conferences of academics and business people

ULCC (?) there are commercial then... i.e. organised for their own profit?

Coordinator (?) who are involved in Africa.

Coordinator (?) Yes, a commercial, show-string operation.

Coordinator (?) oops, shoe-string operation

Coordinator (?) over/

ULCC (?) are they of benefit to us (Commonwealth Secretariat)

Coordinator (?) Well, Comsec gave a presentation at the Dec one here

ULCC (?) OK .. so someone's in touch with them, they were presumably

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Coordinator (?) in London.

ULCC (?) trying to get me along for another conference fee ?? :-)

Coordinator (?) Yes.

Coordinator (?) ULCC, with regard to the ICGITD,

ULCC (?) ta ... looks like NCST has gone for good.

ULCC (?) yep

Coordinator (?) If we were to scrape some money from the CIDA funding, do you think

Coordinator (?) Sysop would be able to work on developing monochrome for this group ?

Coordinator (?) over/

Coordinator (?) this would involve fixing problems already existing on the system

Coordinator (?) and putting in facilities partition topics

Coordinator (?) over

ULCC (?) sorry phone call ...

sysop (?) sorry about that - was talking to Rolly.

Coordinator (?) roly ?

sysop (?) Coordinator, which group are you referring to?

Coordinator (?) the ICGITD one. basically, as the thing stands it is not

Coordinator (?) entirely appropriate for use by the members.

sysop (?) fair enough - if you could let me know what would be appropriate I will

sysop (?) see what can be done.

Coordinator (?) That sounds great.

Coordinator (?) I have to work out a structure for this

Coordinator (?) and come back to you. Just that as your time is in high

sysop (?) ok - when you have done this perhaps we can get together and put it into

sysop (?) Monochrome

Coordinator (?) Great

Coordinator (?) We have a deal then - I will let you know of the

sysop (?) I'll look into the other problems within Monochrome too - I guess that

Coordinator (?) modifications and you can come back to me with a time plan

sysop (?) you are referring to the .record and line lengths within talker here?

Coordinator (?) yes

sysop (?) ok the .record shouldn't be too much of a problem.. the line length

Coordinator (?) Also, as you realise COMNET-IT may be moving to Malta

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sysop (?) thing is in the hands of the person who wrote this system - my knowledge
sysop (?) of C isn't that good to be able to sort that one out
sysop (: nods - yes - I was listening in to the discussion earlier

Coordinator (?) This means that depending on the meeting with the Maltese,

ULCC (?) sorry back now

Coordinator (?) we will know what will be taken care of here

Coordinator (?) at which point I will be able to come back to you with some

Coordinator (?) thing more concrete.

Coordinator (?) over

sysop (?) sure - sounds good.

sysop (?) Are there any 'documents' or information that you would like put up on

Coordinator (?) great, if you don't mind, I have to go now

sysop (?) the system?

Coordinator (?) documents - not at the moment, but for a later ICGITD system - yes.

Coordinator (?) Sysop, ULCC, thank you and good to 'see' you. I must go

Coordinator (?) now.

Coordinator (?) bye

sysop (?) ok - I'll Email you the talker transcript.

sysop (?) ok - bye for now.

Coordinator (?) thanks Sysop !

Coordinator (?) bye

Appendix III

Use of Models

Within the general context of representing the structure of networks, a graphical technique used to describe the structural relationships among social units can best be seen as a map. This is in effect an abstraction from reality that allows the perception of the underlying structure to be seen. Graphical notation is particularly useful to this end and is a useful means of representing networks. A simple representation of the structure of the network can be done using a map. For the purpose of this investigation, maps differ from models in that they are a very basic graphical representation. Maps provide a static representation, whereas models are dynamic, possibly with more sophisticated conceptual images, intended to allow the behaviour of a network to be ascertained.

Following the development of a map, it is often necessary to obtain a dynamic description of the processes being examined. From this map a model may be constructed in order to study the dynamic interactions between these elements. Having identified actors and mapped their relations, it is worth obtaining a more dynamic description of the various ways in which these may function.

The notion of a model is widely used and brings forth a number of connotations. A model may be considered to be a mapping device that represents an abstraction from reality (Frances et al 1991). A. Kaplan (1964) contrasts pictorial realism with a quasi-realist notion he calls instrumentalism which holds that theories and models must be invented or constructed to reflect aspects or facets of observed reality. In other words a theory or model is a device that may be used in a particular way to interpret reality. In similar vein, Hirschheim (1985) states that a model is a symbolic representation of perceived reality. Images of perceived reality may be manifest in different forms, for example, diagrams, simulations, tables, list and the like. A model in this sense is more like a tool or technique with the aid of which we begin to build an image of the world. An example of such a model is described in Auramaki, Hirschheim and Lyytinen (1991).

Models are a useful means of illustrating the processes that take place within the network. An accepted belief is that the value of representing interpersonal interactions and their joint effect is largely to induce participants on to a given view of the organisation. Forming consensus, identifying discrepancies and exceptions, directing discussion towards a target are some of the growing uses of models. It is hoped that the process of building models of network phenomena will be of value in facilitating understanding of the capabilities and limits of the study.

According to a third generation Systems Dynamics perspective, a model is a means of structuring the problem in order to generate some form of understanding. Taken a step further it is a tool to facilitate the learning process within the organisation. Senge and Sterman (1992), suggest that mapping mental models

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involves the explication and sharing of the managers' assumptions. Their context of modelling has to do with the development and improvement of the mental models to be used for strategic management. They believe that the choice of alternative courses of action is only part of a policy-maker's need, it is more important to obtain insight into the nature and complexity of the problem being addressed. It has been recognised by some top managers (ie Shell, Analog Devices, Hanover Insurance) that the ability of an organisation to enhance its performance depends upon its ability to learn. This means that a sustained increase in performance is directly correlated to an organisation's ability to adapt and cope with changes in the environment. The challenge is to help managers reconceptualise complex issues, design better operating procedures and to guide organisation-wide learning.

Systems Dynamics models look upon managers as converters of information from whom decisions and control information ensue (J.W. Forrester 1992). Human behaviour is seen as a conversion of information into human action. This perspective is very much one of control in that an organisation is a complex interlocking network of information channels that emerge at various points to control physical processes. In an industrial organisation these physical processes include the hiring of employees, building of factories and the production of goods. Decision making is seen as a continuous process that converts various flows of information into control signals.

It is Forrester's contention that decisions are attempts to adjust actual conditions towards desired goals, a series of decisions or decision streams always adjust to a given state of affairs and decision points respond to pressures from the environment to take advantage of new developments as they occur. In this sense, the use of models is prescriptive. Policies are reasons for converting information into action. Systems dynamics accepts the 'bounded rationality' interpretation of policy in which decisions are based on limited information and action is directed towards local goals. A major use for a dynamic model is to study the influence of alternative policies on system behaviour. Decisions in a model come under the control of policies and policies control flows at all points. The concept of policies governing decisions is not restricted to human or managerial decisions. Models must also carry out actions that are physical in nature, for example in determining the number of unfulfilled orders that can be filled depending upon the state of inventories.

According to R. Robert Huckfelt et al (1982), social phenomena are seen as processes; they are seen as structured series of events, operations, and activities whose logic is orderly and predictable. The goal of dynamic modelling is to specify the structure of such processes and to deduce the manner in which they generate social change. Dynamic models represent change in a well-defined phenomenon over time using structured tools and techniques.

In some circumstances, an active representation of networks and the information they transmit entails an

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explicit description of dynamic properties. These include processes generating and modifying information, as well as static properties. Dynamic modelling techniques have been particularly useful for problem solving in issues of production, administration and office automation. A host of simulation modelling tools have emerged to this end. However, dynamic modelling does not readily lend itself to analyzing interpersonal networks as social phenomena.

Amongst the popular modelling techniques are object orientated analysis and design techniques that concentrate on the objects that comprise the problem domain. Object orientated techniques are concerned with abstracting relevant objects from the problem domain, defining the objects' structure and behaviour, and determining the objects relationships. The goal is to model the semantics of the problem in terms of distinct but related concepts. They model details of each object's behaviour and interobject communications (messages) necessary to meet the system requirements (Rubin and Goldberg 1992, Monarchi and Puhr 1992).

The petri-net formalism, for example, is a modelling technique that allows the characterisation of concurrency in order to depict parallel systems, they are state and action orientated and at the same time represent information, data and control flows. Petri-nets represent the dynamic behaviour over a given period of time of a set of predefined links. These are limited in their applicability as they focus on modelling the efficiency and control of these well-defined links. Some limited attempts have been made to apply these to modelling office systems as petri-nets are a useful tool for the dynamic representation of information flows (Humphreys et al 1992) as well as software project management (Liu and Horowitz 1989).

Verbraeck and de Vreede (1993) use simulation models to support problem solving processes and to analyze the effects of options for change. They view a model as a translation of the model builder's perception of reality. The main purpose of developing a model is to communicate knowledge of the key aspects of reality while at the same time maintaining a repository of the knowledge contained within the model and studying this from different perspectives.

In summary, it can be said that a model reflects the perceptions of the modeller and those who participate in its creation. It is a symbolic representation of reality as it is perceived by the model builder or researcher as the case may be. Even the choice of tools or techniques with which we attempt to construct an image of the world, are subject largely to our preferences. A model only presents the bare bones for the richness of those elements that it is aiming to elucidate.