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INFORMATION TRANSFER IN ORGANIZATIONAL DYADS

BY

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ABSTRACT

INFORMATION TRANSFER IN ORGANIZATIONAL DYADS

By

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Information transfer in organizations is conceived as influenced by the relationships between people and structures created by these relationships. Granovetter's "Strength of Weak Ties" thesis posits that strong ties primarily transfer information within subsystems and weak ties transfer information between subsystems. A model of information transfer in organizational dyads is developed and tested to explain the conditions that influence information transfer within and between organizational subsystems. Three factors are proposed as influencing information transfer: access to information, relational propensity/strength of tie, and information value. Access to information takes into account the influence of the formal and informal organizational network. Relational propensity/ tie strength reflects Granovetter's concept of tie strength. Information value takes into account the perceptions of the information that is transferred. In addition, to explain when "weak ties are strong", the "bridging" phenomenon is explored in a separate set of analyses of the model.

A field study was conducted in the Michigan Department of Education. The model was tested with all organizational dyads that transfer information. Six hierachically nested alternative models were developed. The best fitting model's fit to the data could only be

increased by 10% if it were modified. An analysis of the model using dyads that bridge and do not bridge subsystems within the formal and informal organization was done. One finding was that the transfer of information in bridge and non bridge dyads in the informal network is affected differently by relational propensity/strength of the tie. This was not found to be the case for boundary (bridging) and nonboundary (non bridging) dyads in the formal organizational network. The implications of this research for organizations are explored and recommendations for future research that focuses on the "strength of weak ties" and the "bridging" phenomenon are presented.

This dissertation is dedicated to Philip, who was there late nights and early mornings, from the first sheet of paper to the last.

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Chapter 1

1.1 Introduction and Overview

The goal of this dissertation is to provide a better understanding of organizations as information processing systems. Information transfer is conceived as influenced by the relationships between individuals and the structures created by these relationships. The focus of this research is the person-to-person movement of information within and between different organizational structures. This dissertation identifies a number of factors that influence the distribution of information when members of an organizational dyad meet and interact.

The strength of the relationship between people in an organization is a focal point of the study. Until the 1970s, the spread of information among people had been largely attributed to high intensity relationships. These strong and enduring relationships were considered the primary conduit for information of any substance. New ideas, gossip, support, and the business of the organization seemed to occur as a result of information exchanges between strongly tied individuals. The ties were defined by factors such as frequency of interaction, similarity, sentiment, and kinship. The assumption was that the stronger the ties between people the greater the opportunities for them to interact and provide each other with information. This belief biased the focus of research away from ties that did not meet some minimal intensity criterion.

Contradictory research results and unanticipated transfer of information within and between organizational systems brought an alternate view of information transfer. Granovetter's (1978) seminal work "The Strength of Weak Ties" contradicted the accepted beliefs about information transfer. He proposed that individuals receive more

information as a result of low intensity ties. These low intensity ties have a greater potential for information transfer because the individuals are less likely to have similar information at their disposal. Granovetter felt that this view not only explained how information flows between organizational systems, but also how information diffuses through social systems in general. The weak tie thesis, though exceptionally useful, also had its flaws. Friedkin (1981) found that all weak ties did not act as conduits for information. Only certain weak ties that he labeled "bridges" actually transferred information. This did not, however, discredit Granovetter's claims since weak ties as compared to strong ties were found to be disproportionately greater mechanisms for information transfer (Friedkin, 1981). The issue not yet addressed by research is establishing what factors affect weak or strong ties becoming bridges.

1.2 Statement of the Problem

This dissertation builds on the premise that two different types of ties operate to transfer information within and between organizational systems. **Strong ties primarily transfer information within subsystems and weak ties transfer information between subsystems.** What is not known, however, is under what conditions these ties will bring about information transfer. The problem to be addressed is to:

1. Reconcile the fact that both strong and weak ties are necessary for information transfer;
2. Specify the conditions under which transfer of information occurs; and
3. Determine the conditions that influence ties acting as bridges.

The problem is compounded by the fact that:

1. Limited research exists on weak ties and information transfer;
2. Weak and strong ties have been defined inconsistently;

3. The unit of analysis in this type of research should be the dyad, i.e., individuals linked to each other rather than individual behavioral traits; and

4. Research that uses the dyad as the unit of analysis is limited.

This dissertation addresses these issues by identifying the factors that influence the transfer of information in an organizational setting regardless of the type of tie that exists. A field study in the Michigan Department of Education was conducted to test the hypothesized model of information transfer in organizational dyads. Individuals within the organization are studied as members of many dyads. Organizational dyads are also partitioned into those that are located within the same subsystem and those that span two subsystems. Ties are defined and identified using Granovetter's (1978) original conceptualization.

1.3 Organization of the Dissertation

The following organizational scheme is used to address these issues in more detail and present the results of the field study. Chapter II is a discussion of organizations as information processing systems, organizational structure and information flow, weak ties and organizational integration, information transfer, bridging organizational structures, and general theories of information transfer. Chapter III is a presentation of the theoretical framework used to develop a more general model of information transfer. Chapter IV is a description of the methods and procedures used in the field study to test the model. The theoretical and measurement models are described in this chapter. Chapter V contains the research results. Chapter VI is a discussion of the results of the field study and presents the implications of this research with recommendations for future research in this area.

Chapter 2

2.1 Organizations as Information Processing Systems

Information is one of the key elements that an organization uses to carry out its primary goals. Lawler and Rhode (1976) note that it is impossible to explain much of the behavior that takes place in organizations without looking at information systems. Organizations have been described as dynamic entities because of how information exchanges occur. Understanding the process which moves information within organizations is crucial for understanding organizations.

The movement of information between entities within an organization is referred to as information transfer. Within an organization these entities might be people, groups, departments, machines, or organizational structures. Katz and Kahn (1978) state that work is accomplished by the transfer of information within the same or between different organizational subsystems. Consequently, how organizations use and manipulate information may be a crucial determinant of the organization's effectiveness. Information transfer processes have also been linked to the communication effectiveness of an organization (Farace, Stewart, & Taylor, 1978).

The transfer and exchange of information in an organization are believed to be essential for achieving rational coordination among organizational entities. This rational view of organizational systems characterizes them as operating essentially to foster and restrain information acquisition and movement (Lawler & Rhode, 1976; Roberts & O'Reilly, 1978). Coordination via information transfer reduces uncertainty and limits choices among a range of alternatives (Porter, Lawler, &

Hackman, 1975; Rogers & Kincaid, 1981).

Information transfer within organizations can be characterized as series of person-to-person exchanges within the context of the numerous organizational subsystems that create the organization. Organizations have also been described as primarily human systems connected and coordinated by the exchange of information (Rogers & Kincaid, 1981). Communication between organizational units does not always imply that information is transfered. Information is extracted from the communication by these organizational members. The transfer of information occurs when knowledge different from that which the unit possesses is obtained. Weick (1969) refers to this as a process of enactment. The organizational unit takes in the communication, makes sense out of it and determines its relationship to information it already has. It then decides what to do with it. The movement of the information is the focus of this research rather than the enactment process by which information detection occurs. Communication between organizational members is crucial to facilitating the coordination of activities. A large amount of information in an organization is interpersonally communicated. Frequently, these interpersonal contacts provide the only means for accomplishing work in a timely, efficient, and cost effective manner. Barnard (1938/1968) characterized these exchanges as crucial organizational activities. Argyris (1964; cited in Lawler & Rhode, 1976) states that how individuals deal with each other influences organizational effectiveness in general.

A primary task of managers and other key decisionmakers is the control of information within an organization. This has led to the belief that information is a commodity that is manipulated and exchanged by members of the organization. One common operating principle within organizations is to maximize information acquisition and distribution and minimize costs in terms of time, energy, and effort

(Arrow, 1974; Mintzberg, 1973; Tushman & Scanlon, 1981). The methods used for controlling the distribution and retention of information may determine the behavior of employees and the organization's success (Lawler & Rhode, 1980). Lawrence and Lorsch (1969), in a study of high and low performing organizational subunits, found that high performance organizational units were able to acquire information about changes in their environment more quickly and with greater accuracy than low performing subunits.

Three indicators used to evaluate information transfer in organizations are quantity, quality and distribution of information. These three aspects of information transfer are interrelated in determining outcomes for organizations. Katz and Kahn (1978) focus on the quantity and distribution issue when they articulate a maximizing principle of information acquisition and distribution in organizations. They note that this principle has positive and negative effects on an organization's adaptation, future functioning, personnel and productivity. A typical negative outcome that results from seeking to maximize information acquisition is overload. In this case, too much information is placed in the system and the system may become stressed. Maximizing distribution might only overburden the system more. O'Reilly (1980) found that reducing subsystem overload alone would not overcome the effects of organizations' maximizing acquisition. He recommended that distribution of information focus on information needs of subunits thereby overriding maximization of acquisition and distribution. This approach appears to take into account the system-specific nature of overload (Farace, Monge, & Russell, 1977).

The quantity and distribution issues are more obvious at the subsystem level. A subsytem perspective focuses on which units or individuals the information comes from and where it goes. The third issue of quality is more difficult to assess. A

problem that organizations routinely confront is that of invalid data being distributed or used for decision-making (Lawler, 1976; Wilensky, 1967). The maximizing principles of acquisition and distribution are a response to the problem of too little information being used. But more information does not mean better information. Optimally, information transferred is accurate and appropriate so that desired results for the organization are to be achieved. The operating principle most likely to be congruent with effective information processing in organizations is the distribution of information based on the information quantity and quality needs of the subsystems. An optimizing rather than maximizing condition is therefore most appropriate for information distribution and acquisition. This optimizing premise, however, dictates that organizations have knowledge of how and where information is acquired and distributed in the organization.

Two general areas of research which explain information transfer within organizations are studies of organizational structure and studies of link properties. The goal of both of these approaches is to explain transfer properties. The difference between the two approaches is primarily one of level of analysis. The structural approach can be categorized as macroscopic. It emphasizes how large system characteristics influence behavior in organizations. Studies of link properties can be categorized as microscopic, since smaller units within the larger system are isolated for study of effects within the system. Roberts and O'Reilly (1978) note that there is extensive literature on micro organizational processes which are discussed parallel to macro organizational processes but not integrated with them. They believe that an:

> . . . elaboration of organizations as information processing systems [using network data] might in the future lead to research which provides evidence of the relationship to structuring of other particularly interpersonal and group relevant communication processes. (Roberts & O'Reilly, 1978, p. 292)

The next sections will present the research on macro and micro organizational approaches to the study of information transfer in organizations.

2.2 Organizational Structures and Information Transfer

Transfer of information can be viewed in the context of two types of organizational structures, the formal and informal. The concept of formally prescribed structures to manage the flow of matter through organizations was first described by Weber (1947). He conceived an idealized structure for the management of organizational functions that optimized the flow of information through an organization. This formal organizational structure was intended to provide the mechanism for monitoring and controlling the distribution of information, i.e., resources, throughout the organization. Individual roles within the organization were laid out. These organizational roles dictated prescribed sets of behaviors or expectations or both which in turn dictated the types of information received and sent (Barnard, 1938/1968; Katz & Kahn, 1978; Simon, 1976; Weber, 1947). As conceived by Weber (1947), an organizational chart is a graphic representation of this structure.

It has been observed that information in organizations moves in ways other than through the prescribed paths in the formally stated orginization. Actual communication and information movement often complements the prescribed roles and functions dictated by the formal organization. Barnard (1938/1968) recognized that informal organizational processes in conjunction with formal organizational processes are instrumental to the transfer of information. Information and orders that flow downward through formal organizational channels of authority and the information that flows upward through these same channels are only a small part of the total network of communication in an actual organization (Simon, 1945). Blau and Scott (1962) note

that:

> The fact that an organization has been formally established, however, does not mean that all activities and interactions of its members conform strictly to the official blueprint, regardless of the time and effort devoted by management to designing a rational organizational chart and elaborate procedure manuals. This official plan can never completely determine the conduct and social relations of the organization's members. (p. 5)

The formal organization, although instituted to optimize information transfer, has a number of shortcomings. The formal organization transfers information at a slower rate, restricts the types of information exchanged and limits the channels that are suitable for information to be transferred. Information acquired via the formal information channels, e.g., announcements, policies, memos, MIS reports, is inherently dated and formal information systems have limited encoding capabilities (Gertsberger & Allen, 1968; Tushman & Scanlon, 1981). Limited encoding abilities imply that there are certain types of information that can not be made formal, such as feelings or personal reactions. Also, the required approval process of routing information through formal channels limits the circulation speed. It is therefore not surprising that organizations accomplish work through the use of informal communication structures. Informal social mechanisms operate as an effective medium for acquiring and encoding timely, current and "soft" information (Aldrich & Herker, 1977; Edstrom & Gailbraith, 1977; March & Simon, 1958; Tushman & Scanlon, 1981). Barnard (1938/1968) describes the informal organization as the potential purveyor of organizational customs, mores, folklore, institutions, social norms and ideals. He also conceives of the informal organization as indefinite and structureless with no definite subdivision.

> How it operates is influenced by a number of factors considered separate from the formal policies and actions of the organization. It may be regarded as a shapeless mass of quite varied densities, the variations in density being a result of external factors affecting the closeness of people geographically or of formal purposes which bring them specially into contact for conscious joint accomplishments. These areas of social density I call informal

> organizations, as distinguished from societal or general organizations in its informal aspects.(Barnard, 1938/1968, p.115)

Both the formal and informal communication structures in organizations affect the flow of information within organizations.

2.3 Dyads as the Location of Information Transfer in Networks

The formal and informal organizational structures are also referred to as the formal and informal networks. A network is the pattern of relationships among members of a system. A member of any network is referred to as a node and the connection between nodes is referred to as a link. The term link and tie are synonymous. The pattern of links between nodes (members) determines the structure of the network. Networks are conceived of as structures composed of linked dyads. Dyads—two linked nodes (members)—are the building blocks of any network. Weick (1969) elaborates on this:

> Even though most networks contain more than two people and more than a single relationship, in actual functioning only one dyad and one relationship are activated at any moment in time. The basic unit in the network remains a dyad, the members of which interlock their behaviors relative to the particular components of the task each possesses. (p. 98)

Rogers and Kincaid (1981) propose that network links represent a potential influence on the behavior of the individual as well as the larger system. Friedkin (1982) notes that:

> Our knowledge about the relationship between social network structure and information flow has remained at a global level because of the paucity of attempts to empirically address specific features of network structure and information flow. (p. 273)

Knowledge of the factors that affect information transfer at the dyadic level can make the transfer of information between larger organizational units more understandable. The dyad is the location of information transfer and the basic unit

to be analyzed to understand information transfer. Information moves as the result of interactions between individuals. The information potential of any of these interactions can be assessed by analyzing the dyad. Granovetter (1980) notes that network research has its limitations since it has not considered the possibility that dyadic properties are artifacts of higher level structures. Weimann (1983a) reinforces this view and believes that "the analysis of interpersonal networks may provide the most fruitful micro-macro bridge" (p. 245). A review of research by Monge, Edwards and Kirste (1978) illustrates this point. They noted discrepancies in the research findings on filtering and gatekeeping in organizations when the flow of information was within or between departments of an organization (e.g., Davis, 1953; Sutton & Porter, 1968). The conditions that influence dyadic behavior may occur as a result of both internal and external dyadic factors. Granovetter (1980) proposes that if one takes the notion of organizational structure as impacting a dyad's behavior seriously then theories should be developed that incorporate both a macroscopic and microscopic perspective. These theories should be developed to incorporate both levels and show lower level properties as being determined by higher level properties. There currently does not exist a theory of information processes that integrates the different levels of analysis in explaining the transfer of information within and between organizational subsystems (Granovetter, 1980).

2.4 Organizational Integration and the "Weak Tie" Thesis

A framework for conceptualizing the effects of multiple system levels on organizational information transfer is Granovetter's "Weak Tie" thesis. Granovetter's (1973) approach attempts to incorporate both a microscopic and a macroscopic perspective to describe how integration occurs in a large system. The "Weak Tie" thesis states that ties that are weak are more likely to transfer information from one part of a

system to another. Weak ties are therefore more likely to act as a conduit for information transfer from one part of an organizational network to another. This is the strength of this type of tie.

Granovetter's (1973) rationale for his thesis is the fact that strong links between individuals tend to be transitive (Rapoport, 1953). For example, if individual A is strongly linked to individual B and individual A is strongly linked to individual C then it is highly probable that individual B will also be strongly linked to individual C. Figure 1 illustrates these relationships.

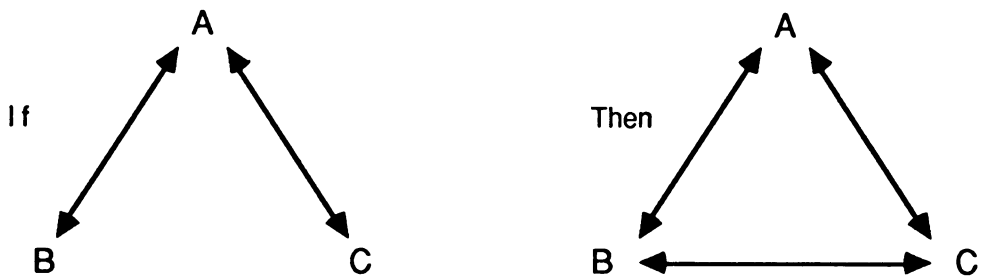


Figure 1: An Illustration of Transitivity in the Relationship among Three Individuals

Strong links between individuals will also tend to create clusters of cliques in which information is shared among all those to whom one is strongly tied. At some point, a saturation effect occurs and the information moved between the individuals in the clique remains the same. No new information exists in the clique.

This new explanation of information movement was revolutionary, since up to this point only strong links were used to describe larger system structures, and links that fell below some strength threshold were not considered important to information processes. Informal network structure was defined by the strongest links within the system. The "Weak Tie" thesis also contradicted the simple proposition that the greater the number of connections (links, ties) among organizational members, the more

information individuals have and consequently, the greater the amount of information distributed.

Recent research has established the importance of weak ties as conduits for information movement (Blau, 1979; Feld, 1980; Friedkin, 1979; Friedkin, 1982; Granovetter, 1980; Lin, Ensel & Vaughn, 1980a; Rogers & Kincaid, 1981; Weimann, 1983a). As noted previously, a tie is the relationship or connection between two individuals and is the same thing as a link. Granovetter (1973) suggests that tie strength be determined by four factors:

1. amount of time invested in the link;
2. the emotional intensity of the link ;
3. the intimacy or mutual confiding between the link ; and
4. the reciprocity of the link.

Granovetter's approach does not propose to eliminate the importance of ties that are strong. His "strength of weak tie" thesis builds on the complementarity of the two perspectives and is parsimonious in explaining system integration as a result of both types of information transfer processes. He believes, however, that the integration of a system occurs primarily as a result of weak tie information transfer.

Integration in systems is the result of information transfer between dissimilar subsystems. Systems are able to achieve integration because of the information received from other parts of the system. Dyads with weak relationships are the conduits for this type of information. Friedkin (1979) expanded on Granovetter's work by articulating separate components of organizational integration. He notes that there are different bases of macro and micro integration.

> Micro integration can be based on weak ties which permit episodic transmissions of information among groups, while micro-integration is based on a cohesive set of strong ties which permit regular transmissions within groups. (Friedkin, 1979, pp. 12-13)

Only recently has research been undertaken with this view of tie strength (Blau, 1979; Friedkin, 1980, 1982; Granovetter, 1980; Lin, Ensel, & Vaughn, 1980; Lin, Vaughn, & Ensel, I980). Several researchers have used it to explain processes such as information transfer, diffusion of innovation, job seeking behavior and the generation of scientific knowledge (Friedkin, 1980; Granovetter, 1974, 1980; Lin, Vaughn, & Ensel, 1980). In some cases it was a convenient explanation for unintended findings (Blau, 1979; Liu & Duff, 1972; Rogers & Kincaid, 1981). Current research and thought indicates that weak ties are considered more likely to:

1. function to infuse novel information into networks (Liu & Duff, 1972) and
2. serve an integrative function in society by joining or "bridging" disparate information systems. (Granovetter, 1973; Friedkin, 1980; Blau, 1979)

Often neglected is an essential premise of this theory that it was not intended to replace or dispute the utility of network research that targets the effects of "strong" links on the transfer of information. Any exploration of the benefits and utility of weak ties should be used to expand the focus of network research. It appears that by dichotomizing link strength into weak and strong ties the potential outcomes for information transfer are assumed also to be dichotomized. This assumption may have resulted in the mixed assessments of the utility of this thesis (Friedkin, 1982; Rogers & Kincaid, 1981). Unfortunately, this weak-strong tie dichotomy has focused attention on which type of tie is instrumental to information transfer rather than its contribution to the movement of information within a system or organization.

2.5 Bridging Organizational Structures and Weak Ties

The conditions that influence the transfer of information between subsystems in an organization should be of paramount concern rather than the type of tie that exists when transfer occurs. The utility of Granovetter's "Strength of Weak Ties" hypothesis lies in its contribution to explaining the conditions under which transfer occurs between

organizational subsystems. The inherent strength in weak ties rests not in the fact that the tie is weak but rather that it can create a pathway to transmit information. A "strong" weak tie is one that transfers information between subsystems. It is the act of transferring information to different cliques, groups or parts of the organization that makes the tie important.

Bridging is a special type of information transfer. It occurs when there is transfer of information between two dissimilar organizational groups or units and new information is infused into one of the groups or units. For bridging to occur, it is assumed that an information milieu or space is created by the composite of the information that exists within any group. Consequently, individuals in the group tend to have similar information because they interact among themselves. The "weak tie" premise proposes that an individual to whom one is weakly tied is more likely to be embedded in a different group that has a different information space. The information contained in the two groups is therefore likely to be dissimilar. When interaction occurs between two individuals from these groups, the information transferred is likely to be different from what the receiving individual currently has. These weak links then function as bridges by joining dissimilar information spaces. The strength of the tie between two individuals may influence whether information is transferred but this relational property alone is not sufficient to explain how information transfer occurs between individuals and subsytems in an organization.

The research questions, therefore, are: (1) what factors cause information to be transferred in a network? and (2) what causes links within a network to bridge information spaces? (Friedkin, 1980; Granovetter, 1980) This orientation takes into account that both strong and weak ties may bridge, but the probability of a bridging tie being a weak tie is higher (Friedkin, 1982; Granovetter, 1980). The issue, however, is bridging rather than tie strength alone.

A study by Friedkin (1979) found that intergroup ties compared to intragroup ties consisted disproportionately of weak ties. He expressed concern that this may be merely a question of quantity, since weak ties are far more prevelant than strong ones (Friedkin, 1982).

Murray and Poolman (1982) note that weak ties in general are of minimal use in "empirical transmission of information" (p. 230). They assert that only certain types of weak ties are important for information transfer. Although Granovetter (1973) presents cogent arguments that weak links are more likely than strong links to transfer information, he acknowledges that all weak ties do not serve this function and that strong ties may also transfer information.

Research on the factors that affect a tie functioning as a bridge are limited. Granovetter (1980) notes that structure and qualities of the individuals linked may influence a tie acting as a bridge. Hierarchical distinctions between ties increased the probability of bridging (Feld, 1980). Coser (1975) found that the facility with language, i.e., using elaborated and restricted codes, influences the type of tie between individuals. Weimann (1983a,b) has made some of the first attempts at empirically studying the bridging phenomenon. His study of kibbutz behavior in Israel is the first to research the bridging function of weak ties. The initial analysis compared individuals according to their network positions and found that marginally positioned individuals tend to function as intergroup communicators, tend to have more weak ties, and that these weak ties mainly act as bridges (Weimann,1983a). Subsequent analysis of these data lent empirical support to the weak tie thesis and an understanding of the factors that may influence a weak tie functioning as a bridge. Weimann (1983a), like Friedkin (1979), found a positive relationship between tie strength and activation rates in intragroup ties and a negative relationship between tie strength and intergroup ties. He was, however, able to show that it was not a factor of mathematical probability alone.

Weimann (1983a) found that weak ties are activated as bridges far beyond their relative inter-group frequency. This was the case for information flow but not for the flow of influence. He notes how he expands on Granovetter's work:

> the present study extends this claim by providing empirical evidence that these bridges are indeed activated as inter-group channels of information, and that their activation rate is greater than would be expected on the basis of their frequency alone. (Weimann, 1983a, pp. 264-265)

Weimann (1983a) suggests that intransitivity and dependency on communication as a result of low multiplexity of the tie explain the strength of weak ties. Intransitivity refers to the lack of completion of the A-B-C linkage. When a weak tie exists between A and B and A and C, and the B to C link is not activated to minimize strain or maintain balance the relationship among the three is considered intransitive. Multiplexity of linkage implies that individuals are linked by more than one type of tie. For example, two individuals that interact in a number of contexts, e.g., work, social, cultural, are multiplexly tied.

2.6 Transfer Processes

The processes that affect information transfer within organizations may be considered as similar or isomorphic to other spread or transfer phenomena. Although the specific variables may be different from those of organizational information transfer, if the underlying processes are similar, the conditions that determine transfer may also be similar. This approach, i.e., to theorize by analogy, provides opportunities to borrow ideas, concepts and methodologies and apply them from one area to another (Brown, 1968; Woelfel & Fink, 1980). Research in the area of information dissemination, diffusion of innovations, epidemiology and the transfer of matter and energy in the physical sciences provide knowledge of transfer processes that can be drawn upon. Common to most transfer processes are the following three essential conditions:

1. the phenomenon to be transferred must exist in the system;

2. a pathway or channel must exist through which the phenomenon can move, i.e., a pathway between an origin point and destination point; and

3. the phenomenon is moved between a point of origin and destination point.

Research on diffusion, epidemiological models and spatial models provide insight about these conditions and the transfer process. Diffusion models provide a useful starting point for understanding transfer processes since they are concerned with the spread and adoption of a phenomenon through a system. Lave and March (1975) specify five assumptions that are, in part, parallel to conditions of information transfer. In order for diffusion to take place between individuals:

1. they must be connected by some kind of relevant communication link;

2. the object of diffusion must be transmitted by the person who has it (note that merely having the object of transfer is not enough);

3. the transmission of the object of diffusion must be accepted by the person who does not already have it;

4. at any point in time an individual either has or does not have the object of diffusion; and

5. the object of diffusion is possessed indefinitely.

Lave and March (1975) also identify three social-structural biases which affect the diffusion of phenomena:

1. interconnectedness/density of the network;

2. the distance between individuals or groups or both, e.g., social, economic, geographic; and

3. social regulation, i.e., factors that restrict or limit spread.

Bott (1955) incorporated the social environment as a contextual determinant of communication in marital dyads. Burt (1976) articulated the need for understanding the influence of the multiple contexts individuals contend with in their daily lives. Multiple contexts are not discussed in diffusion models. A shortcoming of diffusion

literature and research is that most common models for understanding diffusion are descriptive and do not deal with the factors influencing the pattern of diffusion through the population (Rogers with Shoemaker, 1971). Many are models of rate and are only descriptive of macro system processes and tend to focus on the adoption or use of a phenomenon. This is inherent in Lave and March's (1975) last three assumptions.

In contrast to diffusion models, epidemiological models provide more information about the transfer process by presenting the spread of disease in terms of:

1. properties of the disease (the phenomenon);
2. characteristics of the population in which it may spread (relationship among components);
3. the ways in which it is transmitted (susceptibility); and
4. how it moves from one point to another. (See Dietz, 1967)

Discussions of the spread of disease assume it exists within the population and that some person or other type of carrier has the disease or transmits it. For example, if small pox no longer exists in the world, one can not discuss its spread. It must exist within the system studied in order to be considered transmittable. If there are no longer individuals susceptible to the disease or transmitters in contact with susceptibles it can not be transmitted. A contribution to understanding transfer processes provided by spatial diffusion models is the incorporation of time. Brown (1968) specifies the six basic elements for spatial diffusion as:

1. an area or environment;
2. successive time intervals;
3. an item being diffused;
4. locations where items are at time termed places or nodes of origin;
5. destination places; and
6. paths of movement, influence or relationship between origin places and destination places.

Contextual and environmental conditions are integral in this body of research and contribute to understanding this transfer phenomenon.

The approaches used to understand transfer phenomena presented provide the basis for the development of a model of information transfer in organizational dyads. There are obviously differences between information transfer, adoption of an innovation, spread of disease, and movement of populations. However, the similarities in the transfer process are used to specify the conditions necessary for transfer to occur. The processes that influence the transfer of information betweeen individuals in organizational networks are considered within the context of a general model of information transfer (Rapoport, 1953, 1954; Shimbel, 1953). The specific factors that influence the transfer of information within organizations are assumed to be different from those which determine the acquisition of information in general. The underlying process, however, may be the same or similar. This implies that the operationalization of a model of information transfer might be expected to differ depending on the types of information transferred.

Based on the transfer processes reviewed, a model of information transfer within an organizational network should minimally incorporate the following three conditions:

1. the information of interest is present or obtainable by the dyad (system) of interest;

2. a relevant communication link (channel/pathway) exists through which the information can be moved, e.g., personal relationship, friendship, media link; and

3. the information is moved from one point in the dyad to another, i.e., a force activates the movement from one point to another.

The three factors have in one form or another been used to describe transfer processes. They have not, however, been incorporated into a model of information transfer. Variations in the presence or availability of information in the dyad, the existence of a relevant communication link, and forces that move the information from

one point in the dyad to another may be viewed as either a random or a biased process (Rapoport, 1953; Rapoport, 1954). It is generally assumed that information is transferred as a result of biases in the system (Rapoport, 1954). Modeling this process entails identifying the factors that exist which bias or influence the transfer process such that one individual is more likely to receive or send information than another individual (see Rapoport, 1979).

2.7 Summary

This chapter has described organizations as information processing systems. The processing of information in organizations is discussed as influencing an organization's adaptation, functioning, productivity and survival. Two system levels are discussed as affecting information processing in organizations. First, the effect of formal and informal organization structures on the movement of information was presented. Second, the dyad was proposed as the location of information transfer. The necessity and implications of focusing on the dyad as the basic unit of information transfer was presented as a means for understanding integration in organization. The "weak tie" thesis and its implications for understanding the movement of information between subsystems (bridging) within an organization was discussed. A review of literature about transfer and spread phenomenon was presented to provide perspective and insight about the transfer of information in organizational contexts. The following chapter specifies a model of information transfer in organizational dyads that builds on the research reviewed in this chapter.

Chapter 3

Theory

3.1 Development of a Theoretical Framework

The proposed model of information transfer in organizational dyads is based on three necessary conditions:

1. the information of interest is present in the dyad;
2. a relevant communication link exists through which the information can move; and
3. something activates the movement within the dyad.

Variations in each of these conditions determines whether information is transferred. Current information transfer research tends to focus on only one or two of these relevant conditions.

The transfer of information between dyads in an organization first depends on the existence of information in the organizational network and specifically the dyad. Ozga (1960), in formulating a model that addresses information flow in networks, notes that "the only way in which a particular piece of information can be passed on is if one of those who possesses it happens to meet one of those who do not possess it yet" (p. 36). It is assumed that dyads do not randomly have information and that access to information is variable and dependent on the linkages the individuals in the dyad have. The dyad's access to information can be thought of as the access each individual has to the information. This factor takes into account the macroscopic social context the dyad members operate in.

The second necessary condition specified for information transfer is that a relevant

communication link or pathway for communication exists for transferring information. Any two individuals within a network may be minimally thought to link or not link. A dyad exists when a link is established. The relevance of the communication link may vary depending on the relationship established between the dyad members. The strength of the relationship established determines the propensity for members in the dyad to provide information. This condition parallels the emphasis on qualities of the relationship as described by Granovetter(1974). This factor takes into account the more microscopic properties of the individual dyads.

The third necessary condition—that some property activates the transfer of information—reflects the previously stated assumption that transfer occurs as the result of some force moving the information. Transfer of information by definition is the movement of information between an origin point and a destination point. The perceptions of the dyad of the information creates this force. The value of the information, i.e., its importance, may determine the magnitude of the force which brings about transfer between the dyad. The proposed model of information transfer in organizational dyads specifies that:

> Information will be transferred within a dyad when: the dyad has access to information, the dyad has a high relational propensity (tie strength), and the information to be transferred is considered important.

Four theoretical variables are the core of the proposed model of information transfer in organizational dyads. The three exogenous variables specified are :

1. access to information;
2. relational propensity (tie strength); and
3. information value.

These three exogenous variables determine one endogenous variable—information transfer. A representation of the relationship among these variables is presented in

Figure 2. Each of the exogenous variables is considered necessary but not sufficient.

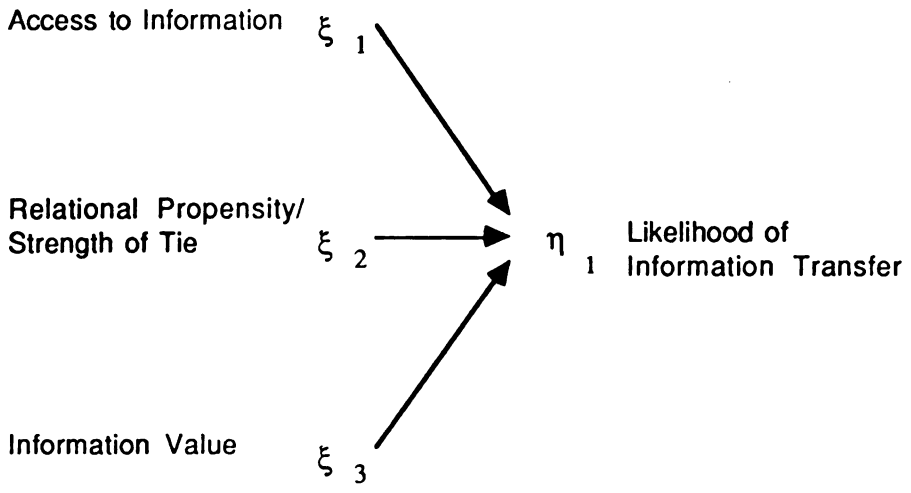


Figure 2. Model of Information Transfer in Organizational Dyads

The four theoretical variables are explicated in the following sections.

3.2 Access to Information

Information must exist in the dyad for it to be transferred. If neither member of the dyad possesses nor is likely to possess the information, it is impossible that it will be transferred. Consequently, the more information that exists or is available to the dyad the greater the likelihood that information will be transferred. Access to information is defined as the degree to which location in organizational communication structures increases the availability of information to the dyad. It is the degree to which linkages exist through which information can be acquired. It is an assessment of the extent to which the structural context in which the dyad exists is conducive to obtaining information. This conceptualization assumes that the more information available to the dyad, the greater the potential for it to be transferred.

Position within networks in conjunction with properties of networks have been found to influence the movement of information to particular points in a network. Early small group studies (e.g., Bavelas, 1950; Leavitt, 1951; Shaw, 1971) found that central individuals influenced others through their communication and were the likely recipients of information because of their location. Location in group structure has been found to be strategic for communication transmission (Coleman, Katz, & Menzel, 1966). Social factors were found to affect the dissemination of information within research areas (Crane, 1972). Burt (1976) reinforces the importance of the structural context in which the dyad exists:

> When two actors exist in a network with several additional actors, an integral aspect of the intensity of the relationship between them consists of their different relationships with each of the other actors in the network. (p. 95)

Allen (1977) found that most accessible channels tended to be used first for information distribution. The more accessible information also was used and processed to a greater degree (O'Reilly, 1982). There may be optimal levels of access for the subsequent distribution of information. If a point in the network is highly accessible the potential for overload may increase and the ability to distribute information in an optimal way decrease (Farace, et al., 1977; Shimbel, 1953). Consequently, both very high and low levels of access may affect information transfer. Shimbel (1953) notes that the more accessible any point in a network is, the more stress it will experience due to information overload. It is possible that if a large amount of information is available to the dyad, the stress created may affect the transfer process. Pool (1980) presents the concept of limits to interaction and the effects of these limits. He notes that there is an upper limit to the frequency of interaction. Frequency of interaction may also affect the quality of the links which may affect what is transferred between dyads. Therefore, access at extreme levels may limit transfer. Friedkin (1981) proposes that

a curvilinear relationship exists between information transfer and the number of links and quality of linkages in a network. A curvilinear relationship between accessibility and information transfer is suggested. The first hypothesized relationship in the model is, therefore:

> H_1: A relationship exists between access and information transfer. This relationship is such that at low and high levels of access, information transfer is less than at intermediate levels.

Access to information in a dyad is determined by structural properties of the networks in which the dyad exists. The position of the dyad in these relevant networks determines access. The activities of the dyad are not considered isolated from the surrounding network but influenced by it (Bott, 1955). A multi-network perspective incorporating structures that tend to move the information of interest is necessary. The position of dyad members within these networks in part determines the likelihood that information will be transferred by the dyad. The issue of multiplexity of links is relevant to this assessment. Multiplexity of links is the degree to which multiple message contents flow through a dyadic link between two individuals (Rogers & Kincaid, 1981). This assumes that individuals can be located in a number of different networks and that each of these networks may provide access to particular types of information (see Burt, 1977; Breiger, 1974; Lawler, 1976). Burt (1980) discusses the concept of network range as indicative of the degree to which organizations obtain control over their environment. He hypothesizes that firms that have the greatest need to co-opt their environment should have the greatest range. Firms obtain the greatest range though a multiplexity of linkages. This coordination of relations of different contents is crucial to expanding the reach of the organization. The same may hold true for individuals and their ability to obtain and use information. The structures, as noted earlier, most relevant to the transfer of information within organizations are the formal and informal networks (Barnard, 1938/1968; Farace et al., 1977; Katz & Kahn, 1966).

3.21 Formal Network

The formal network is synonymous with the formally identified organizational hierarchy specified in an organizational chart. The lines of authority and channels for communication are based on organizational roles. Organizational roles are prescribed sets of behaviors or expectations which may dictate the information sent or received. Information will flow differently to these roles as well as to locations in the actual communication structure. The nature of the ties between a dyad depends on their and others' perceptions of how these ties fit with other role relations among the population (Lorrain & White, 1977). This implies that we act based on our perceptions of others' expectations when we assume a particular role. One of the factors that activitates the transfer of information is our perception of our role in relation to the others and the appropriateness of the transfer of the information given these roles.

There are contacts that are implicit in the formal structure of the organization such that the roles individuals assume bring with them key contacts. Weiss and Jacobson (1960) note that if a member of a relatively stable organization is replaced, the new member will ordinarily be expected to reestablish the work relationships that the previous incumbent had maintained with changes only in the more peripheral contacts.

Research has found that the higher the level (position) in the formal communication network, the greater is the access individuals at these levels have to certain types of information. Individuals tied with those at higher levels in an organization have access to more organizational information than those at lower levels (Jennings, 1971; Presthus, 1962). It is assumed that the higher an individual's status in the organization, the broader his or her view of organizational activities will be (Presthus, 1962). This may occur since the higher a person's social rank, the wider the range of his or her interactions (Homans, 1950). Allen (1977) found that an individual's

administrative position within an organization influences the propensity of others to turn to that person for information. Lin, Dayton and Greenwald (1978), in a small world study that traced the movement of a message through a social system to a targeted individual, support this finding. They found that the person to person chains which reached their destination were those in which connections were made to people of higher status than that of the target. Lin, Vaughn and Ensel (1980) found that the individuals who provided information about jobs to job seekers tended to be at higher hierarchical levels than those who sought the information. The higher an individual's official organizational rank the more likely he or she is to have extensive interorganizational ties and, therefore, more access to information about other organizations (Blau, 1977). Hierarchical distinctions also increase the probability of links being bridges (Feld, 1980).

3.22 Informal Network

As was noted earlier, access to information is influenced by the degree to which channels exist to bring information to the dyad. The second component of access focuses on location of the dyad within informal communication structures. Blau and Scott (1962) comment that:

> It is impossible to understand the nature of a formal organization without investigating the network of informal relations and the unofficial norms as well as the formal hierarchy of authority and the official body of rules, since the formally instituted and informally emerging patterns are inextricably intertwined.
>
> Regardless of the time and effort devoted by management to designing a rational organizational chart and elaborate procedure manuals, this official plan can never completely determine the conduct and social relations of the organization's members. (p. 214)

The communication structure created by the actual patterns of communication among individuals in the organization is referred to as the informal communication network. The structure of the network imposes constraints on the paths through which

information can be transferred. Whether an individual receives information first or at all is a function of his or her location in the network. This structural configuration may vary with communication content. Access to information via the informal network is partly determined by structural properties of the network and by the location of the dyad within the structures of interest. Access is a function of two structural indicators, centrality and network density. Centrality is a property of the individual node in the network, and density is a property of the network structure. Combined these measures can be used to indicate the degree to which information potentially moves to a location (Bavelas, 1950; Becker, 1970; Freeman, 1978; Shaw, 1971). Centrality and density together create an index of informal network access. The following sections will discuss each of these measures.

Centrality is conceptualized as the degree to which an individual in a network has direct (one-step) connections to all other individuals in the network (see Miller, 1980; Monge, Edwards, & Kirste, 1978). Centrality has been used as:

1. an indication of the potential for node activity in networks;
2. an index of potential control of, and influence on, communication; and
3. an indication of the closeness of an individual to all others (Freeman, Roeder & Mulholland, 1980).

Freeman (1978) notes that centrality reflects the potential one has for controlling the flow of information in a network. Centrality may indicate access to information inside and outside the network (Becker, 1970). Crane (1972) found that central individuals in different groups have a tendency to link with other central individuals. Individuals at the center of their respective groups may also be more likely to have information transmitted to them. Coleman et al. (1966), in their seminal work on the diffusion of a medical innovation, found that "for the relatively isolated doctors, by contrast, the networks were not so effective at first as were those for the integrated

doctors" (p. 122). Becker (1970) notes that central individuals are often opinion leaders and may be "granted the position at the level of the group's communication network because of their predilections for outside the group sources of information" (p. 269). Stars of internal networks had a significantly higher degree of contact and information exchange with colleagues outside the organization (Allen, 1977). In the diffusion literature, centrality is discussed as related to opinion leadership (Rogers with Shoemaker, 1971). Information flows to and from this position in a network. Two functions are typically served by opinion leaders: they act as sources of new information being brought into the system, and as relayers of information of interest in the network (Becker, 1970).

The more central a person is in the network, the higher the probability that information will reach him or her. Central individuals have a higher probability of acquiring information because they tend to act as boundary spanners (Rogers & Kincaid, 1981). However, centrality in informal networks, as an indication of information access, must be considered within the bounds of the type of information to which one has access. For example, centrality in the informal social/gossip network of an organization's secretarial staff may not provide access to information about work related issues. Connections to higher level officials may be crucial. Centrality alone, though an indicator of relative position in a network, does not take into account properties of the network as a whole which may influence information accessibility. For example, a person with high centrality in a small cohesive communication network may have different access to information than a person with high centrality in a larger less dense communication network. This may occur since in the less dense network there is less interaction among its members and lower potential for information transfer.

In this case, density of the network restricts the movement of information. Density

coupled with centrality is indicative of access to information. Density is the degree to which individuals in a network are interconnected (Farace et al., 1977; Miller, 1980; Richards, 1974). The density of a network or group restricts the movement of information. Density is conceived of as a function of the direct links between members of a group/network. For example, if all members are connected directly (maximum density), then information may only need to be transferred between two individuals in order for receipt of it by any person in the group. As a network/group becomes less dense there may be a greater number of transmissions necessary for information to reach any individual. Members of highly cohesive groups, which also tend to be dense, have been found to communicate more than members of low cohesive groups (Back, 1951; French, 1941; Lott & Lott, 1961; Shaw, 1976). Density to some extent indicates the degree to which a one step transmission process is probable given the entry of the information into the group/network.

3.3 Relational Propensity (Tie Strength)

Information can only be transferred between two individuals when there exists a connection that can be activated to move the information. If two individuals are not linked, then information can not be transferred between them. It is assumed, however, that the relationship between two individuals may be such that there is a greater likelihood that they will share information rather than withhold it. Properties of the link are a determinant of what moves between the dyad members.

This section will discuss the aspects of linkage that fosters the transfer of information. Granovetter (1973) notes that factors which foster communication are not necessarily the same factors that foster information transfer. Relational propensity/tie strength indicates the degree to which a pathway exists between two individuals conducive to information transfer. Information can only be transferred

between two individuals when a connection exists that can be activated to move information. This concept assumes that there are relational properties of any dyad that increase the potential for information transfer (Boorman, 1975; Friedkin, 1979, 1982; Granovetter, 1974; Lin, Vaughn, & Ensel, 1980). Relational propensity is a variation on tie strength as originally conceived by Granovetter (1973). He defines strength of tie as:

> . . . a (probably linear) combination of the amount of time, emotional intensity, the intimacy (mutual confiding) and the reciprocal services which characterize the tie. (p. 1361)

Strength of linkage (tie) has been used to predict pathways for movement of information. Diffusion studies (e.g., Rogers & Kincaid, 1978), small group studies (e.g., Shaw, 1971), small world studies (e.g., Lin et al., 1978), and network studies (e.g., Granovetter, 1974) have incorporated the concept of link strength and found it positively related to information transfer. The term tie strength is not used because of the inconsistency and confusion in its operationalization (Bearden et al., 1975; Breiger & Pattison, 1978; Friedkin, 1981; Friedkin, 1982; Granovetter, 1980; Lin et al., 1978; Lin, Ensel, & Vaughn, 1980). Typically only one indicator of tie strength has been assessed and the indicator has not been consistent across studies.

The second hypothesis in the proposed model is:

> H_2: The greater the relational propensity/tie strength, the greater the likelihood of information transfer

Three indicators of relational propensity are specified: the closeness of the relationship, the interaction frequency, and the symmetry of the link. Closeness of the relationship is the perceived separation between dyad members. This measure incorporates sentiment and is an assessment of the relationship. The other two indicators are primarily quantitative and indicate amount of exchange rather than quality or intensity of exchange. Symmetry of the link is the degree to which the

relationship is mutual or two way. Interaction frequency is the number of times the dyad communicates. These three indicators have never been used jointly to assess relational propensity or to make any other assessment of tie strength (see, e.g., Granovetter, 1980; Friedkin, 1980; Weimann, 1983). By combining these indicators, a more appropriate test of the implications of weak tie theory is made possible.

Closeness, as specified in the model, indicates the sentiment or distance perceived between members of the dyad. It can influence whether—and what types of—information are transferred between members of a dyad. Any pair of individuals can be characterized in terms of a distance measure, i.e., proximity, between them. Alba and Kadushin (1976) used a measure of proximity based on similarity of the nodes to explain network processes. They assert that a relational dyadic measure has the potential for explaining the evolution of networks.

> By its [proximity measure's] relationship to characteristics of pairs, conceived in terms of homophily or some other fashion, a proximity measure should be an aid in identifying social characteristics affecting the formation of the network or affected by processes occurring through it. (Alba & Kadushin, 1976, p. 81)

The sentiment of the dyad members towards each other may dictate the type and amount of information transferred. Holland and Leinhardt (1972) found that sentiment influences direction and flow of information. Clique formation has been discussed as a function of sentiment (Homans, 1950). VanPouke (1980) noted that dyadic connections based on sentiment tend to be more stable and more durable. The dyad members are inclined to subdue self interest. Davis and Leinhardt (1972) assert that sentiment will influence the resulting relationship. Roberts and O'Reilly (1974) found that trust increased the likelihood that information was transferred. This reinforces Davis's (1970) proposition that measures of sentiment can be used to determine how linkage occurs. Brophy (1976) found that the cognitive distance between pairs of

organizational members was inversely proportional to an index of the total amount of communication between them. The smaller distance could be construed as a measure of similarity or sentiment or both (Brophy, 1976). According to Woelfel and Fink (1980), one would expect links to become stronger through use and that closely connected nodes would tend to become even more closely connected in proportion to their closeness, since increasing similarity brings with it increased coordination in time and space. Granovetter (1973) argued that the stronger the tie, the greater the similarity. Consequently, the stronger the similarity of a tie, the stronger the tie. The closeness measure is a general assessment that takes into account similarity and sentiment.

The second indicator of relational propensity is interaction frequency. Interaction frequency is the number of times members of the dyad communicate in a specified period of time. Interaction frequency may provide the opportunity for information to be transferred. It is typically used as an assessment of linkage (e.g., Farace et al., 1977; Richards, 1974; Shaw, 1976). Homans (1950) hypothesized that the more strongly one is tied with others, the more frequent is communication, and vice versa. Frequency of interaction has been used as an indicator of future contact. Hammer (1980) notes in her study of three different networks that the amount of interaction at one point in time is predicted by the interaction frequency at a second point in time. She found that the greater the frequency of interaction at time one the greater the frequency at time two.

The third indicator or relational propensity is symmetry. Symmetry is the degree to which the link between the dyad is mutual. Link strength has been operationalized as only the degree of symmetry (Friedkin, 1981; Granovetter, 1974). This assumes that the more symmetrical the relationship, the greater will be the strength of the relationship. Symmetry has been explored in relation to the assumptions of transitivity on which much of the study of networks is based (Davis, 1967; Granovetter, 1973; Heider, 1946; Holland & Leinhardt, 1977; Rapoport , 1953, 1954). Holland and

Leinhardt (1977) found that the existence of symmetric, asymmetric or nonexistent links act differentially to create pathways through which information can move. They note that predicting paths for the flow of information must incorporate this bias and that the more symmetrical relationships are, the more pathways exist for information be transferred.

Rapoport (1953) incorporates symmetry in his model to explain information movement in networks. Burt (1980) notes that the effect of symmetry on information transfer may be as a result of prestige or status differentials. Symmetry is also related to the stability of the dyad. Asymmetric dyads consist of single, unreciprocated links. Asymmetric dyads are more likely to cease existing over time than symmetric dyads which would obviously influence the movement of information between these dyads (Hallinan, 1978; Runger & Wasserman, 1980).

3.4 Value of Information

The third factor specified as necessary for information transfer is the value of the information. This variable indicates the existence of a force that causes the information to move from one person to another. Value of information is contingent on qualities of the information as perceived by the one member in the dyad orienting to the other individual in the dyad. This perception may be based on actual or imagined need for information. Value of information is the degree to which the information is perceived as an important entity to have and is desirable to others. It is assumed that actors' perceptions of objects and events are essential for understanding subsequent behavior and that individuals seek to place information where a more satisfactory response will be elicited (Blumer, 1966; Karlsson, 1958). This condition is necessary for information transfer in dyads since it is considered the force that generates the actual transfer of the information within the dyad. Although a link may exist and information

be available in the organizational dyad, only when there is a motivation for providing information is it transferred.

The third hypothesis is:

H_3: The greater the value of the information, the greater the likelihood of information transfer.

Information value can indicate the favorableness, importance, need, or interest of the information. Ozga (1960) found that the more interesting and important the information the greater the attempt to pass it on. Crane (1972) notes that important ideas initiate the growth of a research area, suggesting that the more important the information, the greater its transfer potential. The concept of relative advantage used in diffusion research is comparable to transfer potential (Rogers with Shoemaker, 1971). Innovation diffusion processes are discussed in terms of the relative advantage of the diffusion object (innovation). There is an inherent value process that occurs by which assessments are made of the innovation as it is diffused through a system. Each connection made in the diffusion process may be an assessment of the value of the innovation by the sender for the potential receiver (Rogers with Shoemaker, 1971). In organizations, Simon (1945/1976) states that one reason for upward information transfer between a subordinate and superior is a belief by the subordinate that his or her superior needs the information. Pool (1980) asserts that the risk inherent (relative advantage) in transferring information may determine why information is transferred between particular links.

It should be noted that this variable is determined by the sender of the information. Transfer, however, is still considered a relational process since the sender orients to others in determining whether to transfer the information. Karlsson (1958) notes that message senders will seek to place information with the persons promising the most satisfactory response. Perceptions of the information, rather than an actual value of

the information, is incorporated in the model. Blumer (1966) argues that one can only understand actions from the perspective of the actor. Actors' perceptions of objects, events and outcomes are essential for understanding subsequent behavior.

> Information does not "automatically" transmit itself from its point of origin to the rest of the organization; the individual who first obtains it must transmit it. In transmitting it, he will naturally be aware of the consequences its transmission will have for him. (Simon, 1976, p. 162)

The favorableness of information, i.e., its valence, affects the likelihood of transmission (Roberts & O'Reilly, 1974; Tesser & Rosen, 1975; Tesser, Rosen, & Conlee, 1972). Roberts and O'Reilly (1974), in a study of organizational dyads, found that favorable information is more likely to be transferred in any direction between organizational members. Important information is more likely to be transferred in high trust relationships while unimportant information that is favorable is likely to be passed in low trust relationships. The value of information may also include an assessment of its positive or negative valence. Valence influences tramsmission of information. Tesser and Rosen (1975) refer to this phenomenon as the MUM effect. MUM is not an acronym; however, its origin may be tied to the fact that a deodorant was used in the original experiment in which this phenomenon was observed. The MUM effect is "bias on the part of communicators to encode (transmit) messages that are pleasant for the recipient and to avoid encoding those that are unpleasant" (p. 193). They propose that the MUM effect is based in the communicator's self concern, his concern with the recipient and his concern with norms. Tesser, Rosen and Conlee (1972), in a study of pleasantness of message and probability of transmission, found that the more pleasant the message is perceived to be for the recipient, the more likely he or she is to receive it. The transmission of information is most likely if the message has instrumental value and would create a positive affective state in the recipient as is the case generally when good news is transferred (Tesser & Rosen, 1975).

In addition to valence and favorableness of the information, the interest that exists in the information may generate its transfer. Early studies of rumors found that rumors tend to circulate among those who have the most interest in the rumor (Allport & Postman, 1947; Festinger, Schacter & Back, 1950). Different types of information exhibit different patterns of growth (Crane, 1972). Particularly interesting or important information may cause special contact to be arranged to pass it on (Ozga, 1960). The contrary may also be the case. If information is not perceived as interesting, it may not be mentioned. Ozga (1960) examines the case when the information may be relevant only to a particular group. He asserts that "special interest" information takes more time to diffuse than other information since it directs its flow through the system. VanPouke (1980) notes that in networks formed for the exchange of specific entities, it is not unusual for links to be activated differentially depending on the object to be transferred. The conditional relationship between information value and propensity to inform in determining information transfer is apparent in the Roberts and O'Reilly (1974) organizational dyad study. They found that the quality of the relationship and the importance of the information interactively determined whether information was transferred. The value of the information as perceived by the sender will influence its transmission.

3.5 Likelihood of Information Transfer

Likelihood of information transfer is the endogenous variable predicted by the access, relational propensity and information value. Likelihood of information transfer is defined as the potential for the exchange of information between members of a dyad. It is conceived as a measure of the number of times in the past information has been exchanged on a particular topic or as an assessment of the probability that at some future time particular types of information will be sent from one member of the dyad to

the other.

3.6 Bridges: A Special Case of Intergroup Information Transfer

The model specified represents the transfer of information between any dyad in an organization. Weak tie theory would assert that relational propensity / tie strength would operate differently in the information transfer process when bridging conditions exist. In testing the model, distinctions are not made between dyads based on location or position in the formal and informal networks. The model, however, takes into account the importance of relational propensity (tie strength) as a determinant of information transfer. The logical extension of the current state of research on weak ties is to understand how the factors that cause information to be transferred operate under bridging conditions. After the model of information transfer is specified, the conditions that bring about transfer will be explored given variations in the type of dyad , i.e., bridging vs. nonbridging.

The concept of bridging as defined by Granovetter only specifies that two dissimilar information spaces be spanned. A broad interpretation of bridge will be used that incorporates the definition used in network analysis but expands the concept beyond the informal organization. The model will be analysed with two types of bridging conditions. The two bridge types are those spanning information spaces in the informal organization network and those spanning information spaces in the formal organization network. However to distinguish between the two types of bridges, "bridge" will refer to dyads that span two groups (informal), while "boundary" will refer to dyads that span two organizational units (formal), though both for the purposes of this research are considered bridges. Table 1 presents a breakdown of the types of dyads by network

Table 1. Dyad Types by Formal and Informal Network Location

	Formal Network Units	Informal Network Groups
Within	Non Boundary	Non Bridge
Between	Boundary	Bridge

location. Since location in either network does not preclude location in the other network, a dyad can be both a bridge and a boundary dyad. These two types of dyads are not mutually exclusive.

The question, however, is aptly put by Friedkin (1979): it is not enough to show that bridging ties among network segments are disproportionately weak ties; one must show that something flows through these bridges such as information, and that this information plays some important role for the organization. A premise that is often overlooked in understanding the implications of "weak tie theory" as articulated by Granovetter (1980) and Friedkin (1982) is that both strong and weak ties can act as bridges. The probability of a tie that bridges being weak is higher than one that does not bridge. Therefore, any exploration of the bridging phenomenon must take into account ties of all strengths. However, it is expected that a greater proportion of these bridging dyads will be weak as compared to non bridging dyads. The proposed model of information transfer in organizational dyads will also be tested using the different dyad groups. Comparisons will be made between the different dyad data sets.

3.7 Summary

This chapter presented a model of information transfer in organizational dyads. The proposed model specifies that three factors influence the likelihood of information transfer: access to information, relational propensity to inform, and value of information. The special case of bridging conditions was described and an exploration of this condition presented. The following chapter will present the research methodology used to test the model of informational transfer in organizational dyads.

Chapter 4

Procedures and Methods

This chapter presents the procedures and methods used to test the proposed hypotheses and model. The research site, sampling methods, instrument development and data collection procedures are discussed. A causal modeling methodology is employed which requires the specification of theoretical and measurement models.

4.1 Research Setting

Data to test the model of information transfer in organizational dyads were collected at the Michigan Department of Education (MDE). At the time of the data collection, April 1982, the MDE employed 1,060 people in the Lansing area. The MDE is organized into fourteen service areas under five associate superintendents that report to a deputy superintendent, who reports to the superintendent of public instruction. Two assistant superintendents direct two staff areas for the superintendent. There are four major offices that also provide support services. The reporting relationships are specified in Figure 3, the MDE organizational chart.

The field study was conducted in anticipation of a forthcoming move to a new building. All MDE employees in Lansing were to be relocated into one office building by early 1983. At the time of the study, employees were located in fifteen different locations. The new office areas were to have open-landscaped modular furniture. Ten percent of the total space was to have floor to ceiling walls for offices. These spaces were to be allocated primarily to executive staff. After the move, MDE staff would be located

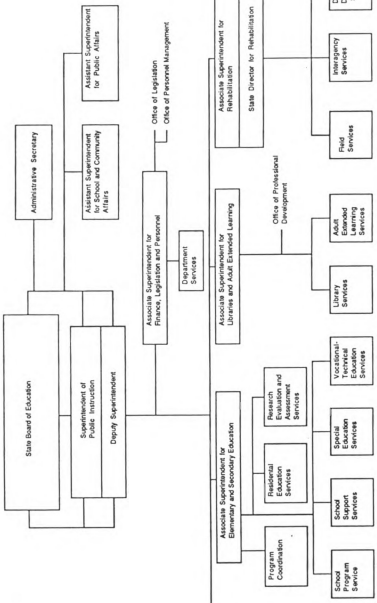


Figure 3. Michigan Department of Education Organizational Chart

near other MDE staff with whom they had had no contact. The move had been planned for several years, but only became a reality in 1980. This prompted speculation and rumor about what it would be like to work in the new building.

This study was the result of MDE executives' concern about minimizing the disruption of work as a result of the move. They believed that optimal distribution of information about the move was essential. The focus of the data collection was the distribution of information about the move. Contact was initiated by the researchers with the assistant to the Deputy Superintendent and Superintendent of Public Instruction. A proposal was submitted by the researchers explaining how the study would provide information that could ease the transition to the new building. The Deputy Superintendent and the Superintendent supported the study and distributed announcements of the study under their names. A presentation was made at the semi-annual MDE staff meeting. Full cooperation was requested of all MDE personnel by these top executives at the meeting. Two weeks prior to the data collection a memo was sent by the superintendent to all participants in the study requesting their full cooperation.

4.2 Sample Selection

Restrictions on study cost precluded a census of the MDE. A sample of 492 MDE employees was drawn to test the proposed model of information transfer in organizational dyads. The sample was obtained using the following inclusion criteria:

1. All persons at the supervisor level and above were included.
2. Service areas were sampled as intact units.
3. Service areas were selected by random sampling.
4. Disability Determination Services, as a service area, was excluded from the sample; however, its supervisory personnel were included.

These criteria were used for several reasons. The census of all managerial level personnel was necessary to provide the MDE with an indication of upper level employees' behavior and attitudes. Disability Determination Services (DDS) was excluded from the sample because of its size and function. DDS is a service area in the the Bureau of Vocational Rehabilitation. This service area receives all of its funds from the Federal Social Security administration and provides direct service to individuals rather than providing administrative support for local programs. There are 337 employees in this service area and inclusion of this service area would have limited the ability to obtain a representative sample of all service areas. It was therefore excluded from the sample. The service areas and offices sampled are representative of all service areas and offices in the MDE. Sampling of service areas and offices as intact units was necessary for the interpretation of the network analysis. The effect of sampling on the validity of network analysis is not known (Granovetter, 1976; Rogers & Kincaid, 1981). Therefore, a conservative approach to sampling with network analysis was used by sampling intact units (Rogers & Kincaid, 1981). The sampling procedure was considered appropriate given the results of a series of 40 interviews with MDE employees. The interviews were conducted to obtain information about MDE employees' views of the move and their work environment. A major finding of the interviews was that most service areas operate as separate and very autonomous functional units. Individuals in these services areas identify with their own service area or office more that with the MDE. Table 2 lists all the MDE service areas sampled. Appendix B provides details on the sampling procedure. Figure 4 is an organizational chart with the locations of the sampled units indicated in the organizational hierarchy.

Table 2. Michigan Department of Education Organizational Units in Sample

The Office of the Superintendent
Associate Superintendents
Assistant Superintendents
Office of the State Board of Education
Office of Public Affairs
Office of School and Community Affairs
Office of Legislation and the Law
Office of Personnel Management
Office of Planning
Office of Professional Developement
Office of Program Coordination
Research, Evaluation, Assessment Services
Student Financial Assistance Services
School Support Services
Special Education Services
Adult and Extended Learning Services
Department Services
Field Services
All members of the Executive and Administrative Councils

4.3 Instrument Development

There were two major concerns in the development of the instrument to use with the MDE in addition to creating a valid instrument:

1. the instrument must be customized for MDE employees, and
2. time demands on respondants must be limited.

In order to accomodate these concerns, a series of 40 in-depth interviews with employees at all levels and all service areas in the MDE was conducted. The interviews focused on the communication in the MDE, reactions to the move to the new building, and attitudes about working in the MDE. A list of the interview questions is provided in Appendix B. The data collected from these interviews were used to create the questionnaire. Language normally used in the MDE and issues relevant to the move were incorporated into the questionnaire.

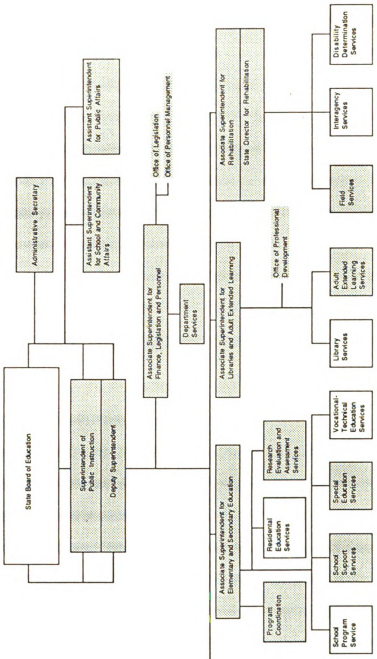


Figure 4: Michigan Department of Education Organizational Chart with Sampled Units Shaded

The instrument consisted of two booklets: a communication directory (network analysis instrument), and a questionnaire about the MDE, job attitudes, and the move to the new Ottawa Street building. Questions about the move to the new building were placed in a different booklet (questionnaire) from the reports on communication behavior with other MDE employees (communication directory). This was done to limit the influence of one section of the questionnaire on the other. It also was done to reduce the perceived response burden on the respondent. The network analysis instrument required twenty-five pages to list the MDE employees in the sample. The type of response required in the directory also differed from those required in the questionnaire. By grouping similar types of questions and separating them into two booklets, the perceived response burden was lessened. See Appendix C for a copy of the instrument.

4.4 Data Collection and Data Processing

The data collection occurred over a three day period in April 1982. The data were collected at the MDE in each service area. Each service area and office was assigned at least a three hour time block for data collection. Prior to the on site data collection, a name list of all participants from a service area was sent to a contact person in the service area. The contact person was responsible for signing up all individuals on the list for a one hour block of time when they would be available to complete the survey. Individuals who were not able to fill out the questionnaire during the assigned time were either assigned alternate days or contacted at a later time to complete the questionnaire. This procedure informed MDE participants about the data collection and helped insure a higher response rate. During the data collection period, participants were allowed to fill out their questionniares at their desks or in a room assigned to the on site team near the service area. See Appendix D for the procedures the on site team followed. There

were seven on site team members. Team members were paired at larger service areas. The last questionnaires and communication directories were collected two weeks after the study team was on site in the service areas. The processing of the MDE data posed a unique problem for the researchers since the MDE data processing unit provided assistance by keypunching the data. The network analysis instrument provides a list of names and ID numbers. Therefore, to maintain confidentiality, all ID numbers were transformed. The ID numbers were later restored to their original state via a matching program. This procedure increased data processing time but insured confidentiality.

4.5 Network Analysis

In order to test the hypotheses, measures of communication structure were necessary. As noted previously, the transfer of information occurs within and is in part determined by communication structures or networks. Networks are defined as systems of overlapping dyadic relationships which together make up the system that is all communication pathways in an organization (Richards, 1974). Structure is considered a property of the system rather than of individuals in the system. Network analysis provides the means for assessing characteristics of informal communication structures. Comparable measures in the formal network are limited (Farace & Pacanowsky, 1974). Network analysis is a method used to study the actual communication structure of a system. Topological properties of network structure are determined. The goal of network analytic procedures is deciphering the underlying structure implied by particular link matrices (Farace & Mabee, 1980). Links between individuals are identified and the larger system is differentiated into smaller groupings.

> Network Analysis identifies these groups and shows us how they are connected, either by direct links between members of the different groups or by links that go through specialized "links". . . people who function as "go-betweens" or "liaisons" to connect the groups. Network Analysis also gives detailed descriptions of the communication flows within the groups as well as flows between groups. (Richards, 1975, p. 3)

Properties of the networks, groups and individual linkages are obtained. There are a number of network analysis programs that identify these topological properties (see Farace & Mabee, 1980; Monge & Eisenberg, 1987; Rice & Richards,1985; Rogers & Kincaid, 1981; for reviews of network analysis methods). The operating principles of these different programs varies. Some programs, e.g., SOCK, are based on personal network overlaps while others focus on direct vs. indirect linkage, e.g., Factor Analysis, Network Routine, and others are based on similarity indexes, e.g., Small Space Analysis, CONCOR, blockmodeling. The NEGOPY computer program (Richards, 1975) was used to identify groups in the MDE. It is a discrete, linkage-based, clique-detection method for structural analysis of large networks (Richards & Rice, 1981). See Appendix E for a description of the NEGOPY computer program.

4.6 Causal Modeling and LISREL

The general model of information transfer in organizational dyads will be assessed using a causal modeling methodology. Causal modeling provides a systematic methodology for developing and testing theories (Bagozzi 1980; Capella, 1980; Fink, 1980). A causal model specifies a cause-effect relationship between variables. Theoretical constructs are related to empirical constructs via correspondence rules and empirical constructs are made observational by operational definitions (Bagozzi, 1980). It may be used to represent a structural equation system. LISREL (Analysis of Linear Structural Relationships by Maximum Likelihood) is a general computer program for estimating unknown parameters in a set of linear structural equations (Jöreskog & Sörbom, 1978). It calculates the maximum likelihood and standardized estimates and standard errors for the parameters of the Σ matrix. Bagozzi (1980) notes four advantages of obtaining maximum likelihood estimates :

1. Estimates are consistent and asymptotically efficient;

2. There is independence of the scales of measurement for variables in the model;

3. Estimates are robust over nonnormality conditions [however, the degree to which these estimates are robust is not known] ; and

4. A convenient statistic can be derived to test the model (see Bagozzi,1980, p.103).

LISREL is used for models with latent variables, measurement errors and reciprocal causation. Latent variables (theoretical variables) are considered the underlying causes of observed, measured variables. Since each equation in the model represents a causal link rather than an empirical association, structural parameter estimates are not typically the same as the regression coefficients obtained when observed variables are regressed on each other (Bagozzi, 1980; Fink, 1980; Jöreskog & Sörbom, 1978).

In contrast, standard regression models assume that variables are measured without error. This is not only unrealistic but is prone to provide biased parameter estimates (Bagozzi, 1980; Fink, 1980). The simultaneous assessment of the theoretical and measurement models is a strength of the approach. An advantage of the newer version of this computer program, LISREL VI, is that it can be used for the analysis of data from several groups simultaneously (SPSS Inc., 1984).

4.7 Operational Definitions

The operationalization of the four theoretical variables, access to information, propensity to inform, information value and likelihood of information transfer will be presented in this section.

4.71 Access to Information

Two indicators of access to information are the dyad's location in the formal network and in the informal network. Relative status was used as a measure of location in the

formal network and an index of centrality/density was used as a measure of location in the informal network.

Individual's relative status (RS) was assessed by using the following formula:

$$RS = (L_h - L_t)/ L_h + 1. \quad (1)$$

L_h is the number of levels in the hierarchy and L_t is the number of levels to the top of the hierarchy from the individual's location in the hierarchy. This measure provides an indication of each individual's relative position in the chain of command. Farace and Pacanowsky (1974) created the relative status index based on perceived rather than organizationally created hierarchies.

Detailed organizational charts were constructed for each service area/office represented on the MDE organization chart. The official MDE chart does not specify levels below the service area/office. The service area/office organizational charts were constructed based on the MDE telephone directory, lists of employees and their positions supplied by the Personnel Office, and discussions with personnel officials. The highest number of levels was 11 from the top of the hierarchy to the bottom. The relative status indicator was carried out to three decimal places. Secretaries were considered as a separate organization for purposes of coding. The Superintendent was coded 2.000 and all other employees were coded 1.999 or lower. Secretaries have lower status in the hierarchy and may therefore have less access to information. However, their access is related to the level of the person for whom they directly work. Therefore, secretaries' status was coded lower than if they were at a comparable level as a nonclerical worker but still within the hierarchy.

The indicator of network access in the informal communication network was derived from two structural measures, centrality and density (See Appendix E for a description of the NEGOPY computer program). Centrality and density measures are provided in the NEGOPY output for individuals that belong to groups. Centrality is a measure of

location relative to others in a group or network. NEGOPY provides an indicator of an individual's relative position in a group. The centrality of a node is an assessment of the average number of links it takes for the original node to link with all the other nodes in the group (Richards, 1975). This measure may be influenced by the number and types of nodes with which one links. For example, if a node links with a central or critical node, this measure is low. It would take few links to reach all parts of the network. The measure of centrality ranges from 1 to 0, with 1 indicating the most centrality. Density is a measure of the degree to which nodes in the network are interconnected. NEGOPY provides an indication of a group's density. Each group's density measure was determined through the NEGOPY program. The formula for density (D) is :

$$D = C_g/C_t. \qquad (2)$$

C_g is the number of actual connections among group members, and C_t is the total number of possible connections. Nodes in a group were assigned the density measure for the group they were in. Access in the informal network is determined as the centrality of the node (individual) divided by the density of their network or group. This indicates the relative location in the informal network.

4.72 Relational propensity.

There are three indicators of relational propensity: closeness, interaction frequency, and symmetry of the link .

Closeness was obtained by magnitude estimates of the closeness of the relationship between individuals in the dyad. Respondents were asked to estimate "How closely you see yourself associated with each person" they had or would give information about the new building. The following explanation was given in the instrument of how the respondents were to view closeness:

> We vary on how closely we see ourselves associated with other people. There are some people that we identify with and think of our relationship as

close. There are others that in spite of the fact that we frequently have contact with them we do not view the relationship as close. Work as well as non-work-related factors may influence how close we view our association with others.

The scale used to assess closeness had a range of 0 to 100. Zero indicated no closeness and one hundred the maximum degree of closeness.

Interaction frequency was assessed on the following seven point scale:

1 = once a year
2 = a few times a year
3 = once a month
4 = a few times a month
5 = once a week
6 = a few times a week
7 = once a day or more

The respondents reported how often they interacted with other MDE employees . The seven point scale was used for ease of estimation since the time period considered was long. An approximation of the actual number of times interaction occurred was obtained by transforming the seven point scale. The following formula was used which operated within the constraints of the NEGOPY program and provided the best estimate of interaction frequency:

$$x^{*} = (.1 + .90\ (x))^{3}. \qquad (3)$$

"x^{*}" is the estimated frequency of interaction and "x" the reported frequency using the 1-7 scale. The NEGOPY program allows the user to transform the reported frequencies with a weighting formula. When creating the matrix of the dyad data, the same transformation was used to be consistent.

Symmetry was assessed by the reported communication between dyad members. If only one node in a dyad reported communication, the relationship was considered asymmetrical or one-way and it was coded as "1." If both reported the communication the relationship was considered two-way and it was coded "2."

4.73 Information Value

The two indicators of information value are information value to self and information value to others. Both of these indicators are specific to information about the new building. Respondents were asked to respond for themselves and for others to two questions.

1. It is important to me:
   - to have lots of information about the Ottawa Street Building.
   - to get more information about the Ottawa Street Building.
2. It is important to other MDE staff:
   - to have lots of information about the Ottawa Street Building.
   - to get more information about the Ottawa Street Building.

A seven point scale from Strongly Disagree (1) to Strongly Agree (7) was used. An index was created for each of these questions by adding together the responses for each item and dividing the number by 2. This was done as an indication of information value for self (1) and others (2).

4.74 Likelihood of Information Transfer

There were two indicators of the likelihood of information transfer. The first indicator is a magnitude estimate of the number of times information about the new building had been transferred in the dyad. Respondents were asked to estimate how many times in the last three months the other person in the dyad gave them information about the Ottawa Street building (see Appendix C: MDE Questionnaire, p. 4). The second indicator of likelihood of information transfer was an estimate of the probability (0-100) that the respondent would provide the other member of the dyad information about the Ottawa Street building that was included in the questionnaire (see Appendix C: MDE Questionnaire, pp. 5-6).

4.8 Creation of the Dyad Data Set

The dyad data set used to test the proposed model of information transfer in organizational dyads was created from data from the instruments, MDE records and group data from NEGOPY. Only those dyads that transferred information about the Ottawa Street Building are of interest to test the proposed model. Dyads that have not or would not transfer the information were excluded for purposes of this study. This was necessary since the focus of this research is the factors that influence the transfer of information.

4.81 Creating Dyads.

Creating the dyad data set posed a number of problems. There does not currently exist a network analysis program that provides for the analysis of links on more than a few variables. The output data need for testing the proposed model could not be obtained by any of the currently existing network analysis programs. Therefore a procedure was necessary that could identify and transform individual data into dyadic data that would be amenable to further analysis by other statistical programs, i.e., SPSS^{X} and LISREL. A computer program was created to handle the procedure.

The process used to identify the dyads is similar to that used by network analysis. The frequency of communication with other participants in the study about work, nonwork and the new building was used as the basis for establishing that a dyad exists. There were no cut off points to establish a link's existance as is typical in other network programs. This was necessary since weak as well as strong ties were of concern in this research. A person to person matrix was constructed which included all the communication data as well as all the individual level data for each dyad member. The communication contact could be reported by one or both individuals in the dyad. If both reported contact, the relationship was symmetrical. If only one reported contact, the

relationship was asymmetrical. To establish dyadic measures the following procedures were used to combine the data.

4.82 Calculation of dyadic variables.

For all variables in which there was a reported dyadic behavior or a relationship (i.e., frequency of communication, closeness) the following computation was used to arrive at the dyadic variable.

1. If only one person in the dyad provided data on the variable, the data were used to represent the dyadic variable.
2. If both individuals provided data on the variable, an average was taken.

For example, to calculate nonwork interaction frequency for the dyad the following formula would be used:

$$AB_{nw} = (A_{nw} + B_{nw}) / 2 . \quad (4)$$

AB_{nw} would represent the dyad's nonwork communication. A_{nw} is the frequency of nonwork communication reported by person A. B_{nw} is the frequency of nonwork communication reported by person B. The same type of formula for work communication was used. However, to calculate work communication, AB_w was substituted for AB_{nw} and $(A_w + B_w)$ for $(A_{nw} + B_{nw})$. If either A or B did not report on the dyad's communication, an average was not taken. For example, if for A_{nw} there was no report on communication frequency, then the formula for the dyad's nonwork communication becomes:

$$AB_{nw} = (B_{nw}). \quad (5)$$

This procedure was used to calculate the following dyadic variables: closeness, communication about the new building, and the likelihood of communication about the new building.

To obtain a measure of the dyad's general communication, the sum of work and nonwork communication for the dyad was combined:

$$AB_g = AB_w + AB_{nw}; \quad (6)$$

AB_g is general communication for the dyad. For purposes of this study, work and nonwork communication are considered mutually exclusive categories that comprise the universe of communication contact in the organization. The frequency of interaction is the same as general communication and considered the sum of all work and nonwork communication.

4.83 Derived Individual Network Data

Output from the NEGOPY computer program was used to arrive at individual measures of density and centrality. The individual reports of communication frequency (work, nonwork and general communication) were analyzed in order to identify how individuals clustered in the organization. The two networks were used to take into account the multiplexity of linkages. These groups were identified and each individual was assigned either to a group or classified as a nongroup member. Each individual assigned to a group was assigned a score for density and centrality.

Informal network location was measured as a ratio of centrality to density. The dyadic measure is, however, considered the sum of the measures for the two dyad members. An average is inappropriate since each brings more access to the dyad. The formula used to calculate informal network access is:

$$A_{AB} = A_A + A_B$$

or

$$A_{AB} = C_A/D_A + C_B/D_B. \quad (7)$$

A is the access in the informal network, $_A$ or $_B$ indicate a dyad member, C indicates centrality, and D indicates density. A_{AB} is the access in the informal network of the dyad. For relative status, value of information to self, and value of information to

others, the dyadic measure was also created as a sum of the individual data.

4.9 Specification of the Theoretical and Measurement Models

To test the hypotheses specified earlier a causal modeling methodology is employed. The two components of the causal model, the theoretical and measurement model, will be presented in this section.

The theoretical model specifies the relationship between the latent variables. The proposed model specifies that three exogenous variables: (1) access to information ξ_1, (2) relational propensity ξ_2, and (3) value of the information ξ_3 increase the likelihood of information transfer, η_1. The model is recursive, which implies that there are no two variables that are reciprocally related and no variables feed back upon themselves through any indirect links (Heise, 1975). The model as it is depicted in Figure 5 specifies an additive relationship between the three exogenous variables. The corresponding equation is:

$$\eta_1 = \gamma_0 + \gamma_1\xi_1 + \gamma_2\xi_2 + \gamma_3\xi_3 + \zeta_1. \quad (8)$$

γ_0 is a scaling constant, γ_i the parameters to be estimated and ζ_1 is the error of prediction. However, the proposed model does not assume that the relationship among the variables is necessarily additive. The three exogenous variables may be conditioned on different levels of the other variables. It can not be assumed that linear in equation implies linear in variables. In order to test the assumption of linearity as well as homogeneity of variance, scattergrams of the predicted variables against the residuals will be inspected for patterns that indicate transformations may be necessary (see Mosteller & Tukey, 1977).

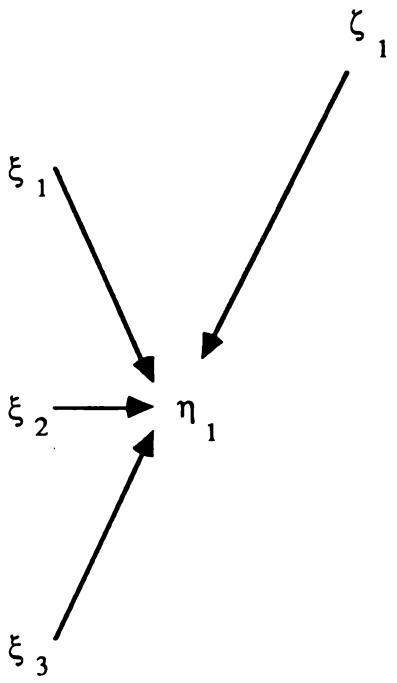


Figure 5. Full Theoretical Model of Information Transfer in Organizational Dyads

The measurement of the variables influences the estimates obtained. Fink (1980) notes:

> Endogenous variables in a structural model are best conceived of as continuous variables; if measured by bounded scales (such as probabilities) they will often require mathematical transformation if they are to meet the statistical assumptions required to estimate and test a structural equation model. Exogenous variables may be conceived of as continuous or discrete, depending on the kind of explanation they expect to provide in the model. (pp. 121-122)

The measurement model specifies how the theoretical constructs are measured in terms of the observed variables and is used to describe the measurement properties (validities and reliabilities) of the observed variables (Bagozzi, 1980; Jöreskog & Sörbom, 1981). The two measurement submodels as depicted in Figure 6 illustrate that in the exogenous submodel there are two indicators for access to information, ξ_1, location in the formal network, x_1, and location in the informal network, x_2. ξ_2,

relational propensity/tie strength, has three indicators x_3, closeness, x_4, frequency of communication, and x_5, symmetry. ξ_3, information value, has two indicators, x_6, information value to self, and x_7, information value to others. In the endogenous measurement submodel, η_1, likelihood of information transfer, has two indicators y_1, information transfer in the past, and y_2, information transfer in the future. The following are the structural equations (mean corrected) for the proposed model of information transfer in organizational dyads. The structural equation for the theoretical relationships as depicted in Figure 5 can be written as:

$$\eta = [\gamma_1 \quad \gamma_2 \quad \gamma_3] \begin{pmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \end{pmatrix} + \zeta \tag{9}$$

$$\text{or} \qquad \eta = \Gamma\xi + \zeta \tag{10}$$

The measurement equations as depicted in Figure 6 are:

$$\begin{pmatrix} y_1 \\ y_2 \end{pmatrix} = \begin{pmatrix} \lambda_1 \\ \lambda_2 \end{pmatrix} \eta + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix} \tag{11}$$

$$\mathbf{y} = \Lambda_{\mathbf{y}}\eta + \varepsilon \tag{12}$$

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \end{pmatrix} = \begin{pmatrix} \lambda_1 & 0 & 0 \\ \lambda_2 & 0 & 0 \\ 0 & \lambda_3 & 0 \\ 0 & \lambda_4 & 0 \\ 0 & \lambda_5 & 0 \\ 0 & 0 & \lambda_6 \\ 0 & 0 & \lambda_7 \end{pmatrix} \begin{pmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \end{pmatrix} + \begin{pmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \\ \delta_4 \\ \delta_5 \\ \delta_6 \\ \delta_7 \end{pmatrix} \tag{13}$$

$$\mathbf{x} = \Lambda_{\mathbf{x}}\xi + \delta \tag{14}$$

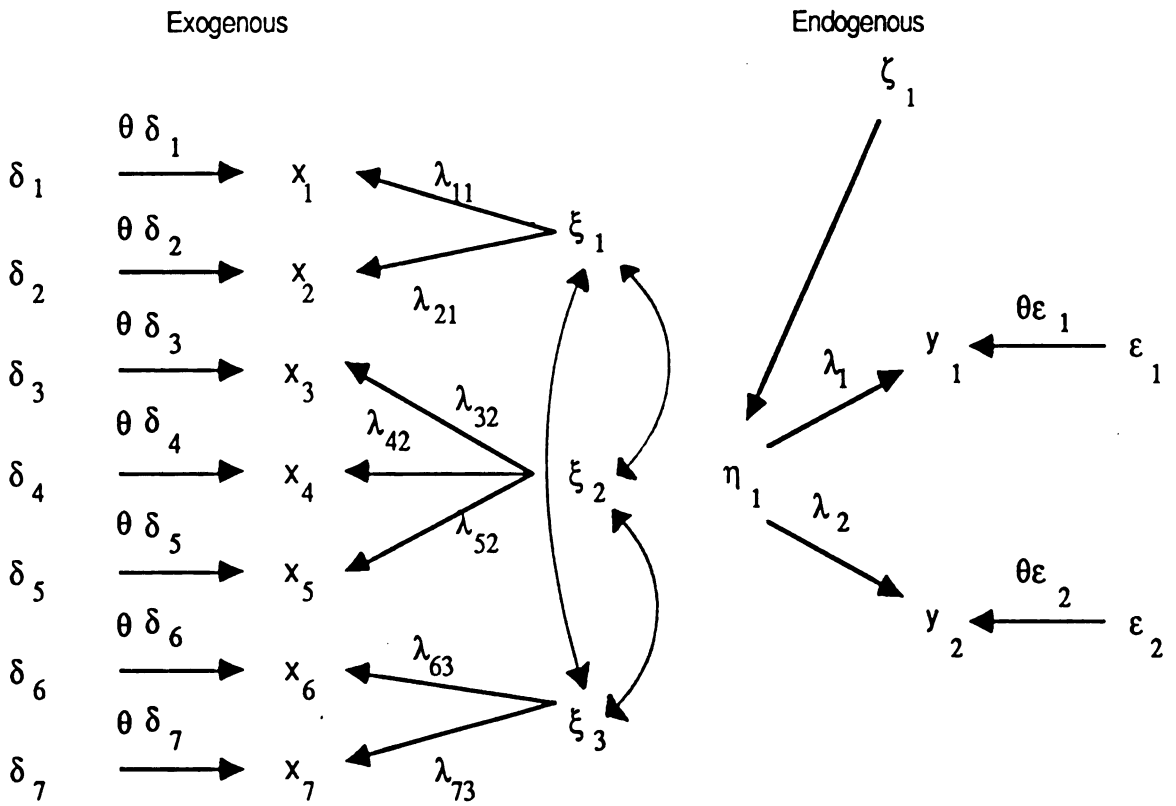


Figure 6. Measurement Submodels of Information Transfer in Organizational Dyads.

Glossary

X_1	Access in the formal network	ξ_1	Access to Information
X_2	Access in the informal network	ξ_2	Relational propensity/strength of tie
X_3	Closeness	ξ_3	Information value
X_4	Frequency of communication	y_1	Number of times information transferred in the past
X_5	Symmetry	y_2	Probability of future information transfer
X_6	Information value for others	η_1	Information transfer
X_7	Information value for self		

The full model as specified meets the necessary condition for over identification according to the counting rule, with 20 over identifying restrictions (see Bagozzi, 1980; Jöreskog & Sörbom, 1977; Kenny,1979).

4.10 Test of the Model

Three procedures will be used to test whether to accept or reject the proposed model. The first test of the proposed model is a χ^2 goodness of fit test of the proposed model versus a saturated model. This procedure assesses whether the set of restrictions implied by the proposed model and its parameters can be reproduced by the observed data. The general hypothesis, H_5, that denotes this is:

$H_0 : \Sigma_R = \Sigma_U$

$H_A : \Sigma_R \neq \Sigma_U$

Σ_R is the restricted population covariance matrix based on the proposed model and Σ_U the unrestricted population covariance matrix of the observed variables. A nonsignificant goodness of fit χ^2 indicates that the reconstructed covariance matrix based on the model's restrictions fits the observed data (Fink & Monge,1985; Jöreskog & Sörbom,1981). One problem with the χ^2 test statistic is its sensitivity to sample size and gross departures from multivariate normality. Both of these conditions affect the χ^2 statistic above what can be expected due to specification error. Large sample size tends to inflate the χ^2 statistic. A recommended approach for assessing goodness of fit with large samples is computing a χ^2/df ratio. If the ratio is 5 or less the model can be assumed to provide an acceptable fit (Wheaton, Muthén, Alwin, & Summers, 1977). Fit can also be assessed by an examination of the t values, modification indices and residuals (Jöreskog & Sörbom, 1981).

The second approach to test whether to accept or reject the proposed model requires

the development of a null model which specifies that there are no relationships in the observed data. This null model is compared to the hypothesized model. The general hypothesis, H_6, that tests the null model is:

$$H_0 : \Sigma_0 = \Sigma_R$$

$$H_A : \Sigma_0 \neq \Sigma_R.$$

Σ_0 is the population covariance matrix for the null model and Σ_R is the population covariance matrix for the proposed model. A χ^2 statistic is computed for the null model and compared with the χ^2 statistic for the proposed model. The difference between the two chi square statistics, χ^2_d, is distributed as χ^2 with the degrees of freedom equal to the difference between the degrees of freedom (df_d) of the two models. The significance of the difference will be assessed at the $p \leq .01$ level which is a more stringent test of difference. This more stringent test is used because of the likelihood of inflation of the χ^2 statistics due to a large sample size.

The third procedure to determine whether to accept or reject the proposed model is concerned more with practical differences rather than statistical differences in the degree of fit the proposed model achieves. Bentler and Bonett (1980) recommend using two incremental fit indexes, Δ, the normed fit index, and ρ, the non normed fit index, to indicate the proportion of fit achieved by the model. This procedure is also useful in assess incremental fit of alternative models.

4.11 The Special Case of Information Transfer in Bridge Dyads

Given the acceptance of the proposed model of information transfer in organizational dyads, the next step is to understand how the factors that affect the transfer of information operate in ties that bridge information spaces. To respond to the hypotheses posited about the bridging phenomena, the dyad data set will be partitioned into dyads that bridge or do not bridge in the informal and formal networks. Table 3 identifies the

four data sets that will be used.

Table 3. Partition of the Dyad Data Set by Type of Network and Type of Linkage

	Formal Network Units*	Informal Network Groups**
Within	Non Boundary	Non Bridge
Between	Boundary	Bridge

* Determined by the organizational chart, e.g., Service areas, offices, special programs.

** Determined using NEGOPY, e.g., group members, non group members.

The general category of bridging and non bridging dyads is identified by whether the dyad members are in the same or different groups. Informal groups have been identified by the NEGOPY computer program. A bridge dyad is defined as a dyad that has members from two groups. A non bridge dyad is one that has members from the same group in it. The boundary or non boundary dyads are determined by whether the dyad members are in same or different organizational units. A boundary dyad is a dyad that includes employees of different organizational units. A nonboundary dyad is a dyad that is made up of employees of the same organizational unit. The two categories, boundary and bridge, are not mutually exclusive. Information transfer factors are expected to differ for bridges. Comparisons between bridges and nonbridges will be made using the model.

This assumes that the general model of information transfer in organizational dyads is acceptable. The differences are assessed by differences in the distribution of the relationships between the latent variables.

H_0: $\Gamma_{NB} = \Gamma_B$

H_A: $\Gamma_{NB} \neq \Gamma_B$

NB indicates nonbridging dyads and B indicates bridging dyads. The null hypothesis states that there are no differences between coefficients of the relationships between the latent variables in the nonbridging dyads and the bridging dyads. One expectation is that the effect of relational propensity/ strength of ties will be different between dyads that bridge information spaces and those that do not. This will be tested for the formal and informal network. Therefore bridge dyads will be compared to nonbridge and boundary will be compared to nonboundary dyads. This comparison is a test of the invariance of the theoretical structural relations across the different dyad groups.

4.12 Summary

This chapter presented the procedures and methods used to test the model of information transfer in organizational dyads. The research setting, sample selection, instrument development, and data collection procedures and processing were discussed. Operational definitions of the variables were provided. The measurement and theoretical model were specified and the tests of the model presented.

Chapter 5

Results

This chapter presents the results of the test of the proposed model of information transfer in organizational dyads. The impact of bridging conditions on information transfer is explored.

5.1 Response Rate

As noted in Chapter 3, the sampling of MDE personnel was done primarily by organizational unit to obtain useful network information. A high response rate was required for the results of the network analysis to be considered viable. Each unit that was sampled also required a high response rate in order to obtain useable data. Guidelines do not exist for establishing what are acceptable sample sizes, therefore the procedures used attempted to maximize the response rate. The original sample size drawn was 492, however, by the time the questionnaire was prepared, the sample size was reduced to 478. Through attrition and layoffs that occurred between preparation of the questionnaire and the data collection the actual sample size was 448. Only questionnaires that had both sections completed were considered useable. The number of useable completed questionnaires was 420. A response rate of 94% was obtained by dividing the number of useable completed questionnaires (420) by the actual sample size (448). Table 4 lists all the organizational units included in the sample, the number of individuals sampled from each unit and the response rate for each unit as well as the totals. Partitioning the response rates of the seven organizational units sampled as intact units into deciles the following results are noted: three units had a

TABLE 4. Response Rate by Organizational Unit of the Michigan Department of Education

	N	Number of Respondents	Response Rate
Adult Extended Learning Services*	32	32	100%
Bureau of Elementary and Secondary Education	5	4	80%
Bureau of Finance and Legislation	2	2	100%
Bureau of Libraries and Adult Extended Learning Services	4	4	100%
Bureau of Rehabilitation	4	4	100%
Department Services*	95	86	91%
Field Services*	17	15	88%
Interagency Service	2	2	100%
Office of Legislation and School Law	4	3	75%
Office of Personnel Management	13	13	100%
Office of Professional Development	4	4	100%
Office of the Superintendent	12	12	100%
Program Coordination	13	12	92%
Public Affairs	4	2	50%
Research, Evaluation, and Assessment Services*	27	27	100%
School and Community Affairs	18	14	73%
School Program Services	4	4	100%
School Support Services*	38	34	89%
Special Education Services*	50	49	98%
State Board of Education	2	2	100%
Student Financial Assistance Services*	86	86	100%
Teacher Preparation and Certification Services	3	2	66%
Vocational-Technical Education Services	9	9	100%
TOTAL	448	422	94%

* These organizational units were sampled as intact units.

100% response rate, and two units had a response rate between 90-99% (one unit at 98% and and one unit at 91%, two units had response rate between 80-89% (one unit at 89% and one unit at 88%).

5.2 Descriptive Statistics

The unit of analysis for testing the proposed model of information transfer in organizational dyads is the dyad, and not the individual. The focus for this research was only those dyads that were likely to or who had conveyed information about the new Ottawa Street building. The actual number of dyads identified in the MDE was 10,318. Of these dyads, 713 conveyed information about the new Ottawa Street building. These 713 dyads provided the data that were used to test the proposed model of information transfer in organizational dyads. These 713 dyads may include one individual in more than one dyad. The degree of influence of this violation of the independence assumption on the statistical tests is not fully known. Blalock (1972) notes that

> It is often rather difficult to assess the seriousness of errors introduced when required assumptions, such as independence, are not met. We are on safe ground whenever we can be assured that assumptions required for any test are met; if they are not met, it is seldom possible to determine just how much we are departing from these assumptions. (p.145)

Preliminary descriptive statistics were performed using SPSS^X (SPSS Inc.,1986) for the 713 dyads. These descriptive statistics are presented in Appendix F.

As noted in Chapter 4, a series of scatterplots were created in which the residuals of the regression of the x and y variables were plotted against the predicted variable. The shapes of these scatterplots were examined to determine whether the assumption of homogeneity of variance, a necessary condition for testing a causal model using maximum likelihood technique or regression, was appropriate. This assumption appeared to be met (See Mosteller & Tukey, 1977).

5.3 Test of the Full Model of Information Transfer in Organizational Dyads

This section will present the test of the model of information transfer in organizational dyads as specified in Chapter 4 and a series of alternative models. Figure 7 is the causal diagram of the full model (measurement and theoretical) with all the parameters to be estimated. A glossary of the variables in the model is provided with Figure 7. Table 5 is the matrix of correlations and standard deviations based on n = 713 observations. One of the benefits of a causal modeling methodology is that all the relationships to be tested are specified. These relationships can be subjected to closer scrutiny when components of the model do not operate as specified. The proposed model could not be tested without modification. Jöreskog & Sörbom (1981) noted six clearcut indicators that a model is fundamentally wrong: negative variances; correlations which are larger than one; not positive definite correlation or covariance matrices; negative squared multiple correlations or coefficients of determination; large standard errors; and highly correlated parameter estimates. These problems were apparent in the original model. This led to an exploration of the areas where modification of the proposed model was needed. The procedure used to determine how to modify the model involved first assessing the measurement model's viability and modifying it before proceeding to modify the theoretical components of the model. Fink and Monge (1985) recommend that:

> In general, creating such "full" models is preferable, since our estimates will be expected to have less variability. When such full models are statistically rejected, we may examine the extent to which the separate measurement components of the model were plausible, by subsequent use of CFA. (p. 195)

An examination of the exogenous and endogenous measurement submodels was executed as the first step towards modifying the full model. In order to allow estimation of the unobserved variables, a metric was set by assigning a nonzero value (1.000) for

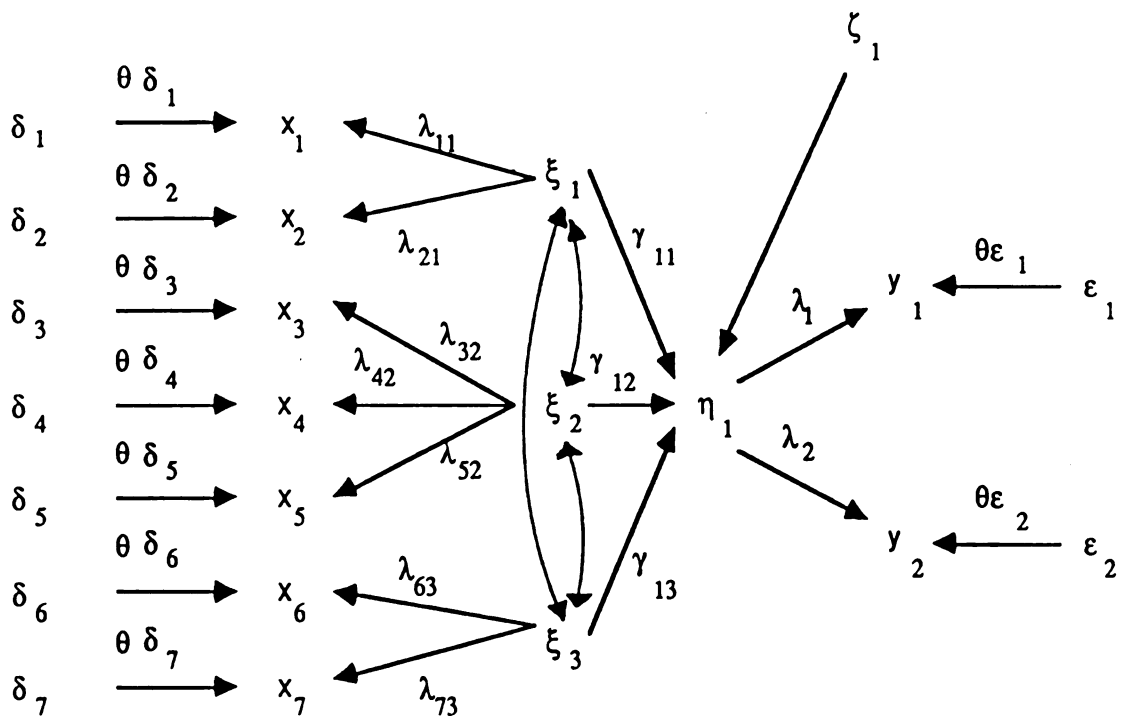


Figure 7. Full Model of Information Transfer in Organizational Dyads

Glossary

X_1	Access in the formal network	ξ_1	Access to Information
X_2	Access in the informal network	ξ_2	Relational propensity/strength of tie
X_3	Closeness	ξ_3	Information value
X_4	Frequency of communication	y_1	Number of times information transferred in the past
X_5	Symmetry	y_2	Probability of future information transfer
X_6	Information value for others	η_1	Information transfer
X_7	Information value for self		

TABLE 5. Correlations and Standard Deviations (on the diagonal) among the Nine Indicators in the Model of Information Transfer in Organizational Dyads for all Dyads. N = 713

		x_1	x_2	x_3	x_4	x_5	x_6	x_7	y_1	y_2
Formal Network Location[1]	x_1	28.3161*								
Informal network location[1]	x_2	-.2557	78.2209							
Closeness	x_3	-.0775	-.0117	28.8535						
Frequency of Communication	x_4	-.1831	.0467	.4318	67.7807					
Symmetry[3]	x_5	.0439	-.0140	.0388	.0712	39.6440*				
Information Value to Others[2]	x_6	.2764	-.1642	.0236	-.0149	.1493	61.8011*			
Information Value to Self[2]	x_7	.3855	-.1866	-.1007	-.0934	.1922	.5901	59.5553*		
Information Transfer in the past[2]	y_1	-.0078	.2337	.0387	.1452	-.0471	.0744	.0823	46.5170*	
Information Transfer in the future	y_2	.0845	.0414	.5380	.2781	.0029	.0127	-.0207	-.0678	25.9727

*Because of the arithmetic precision of the computer algorithm used, a linear transformation of this variable's variances was performed to allow LISREL to provide model estimates. This transformation has no effect on the results and tests of significance.

[1]Variable transformed by multiplying the variance by .01.

[2]Variable transformed by multiplying the variance by 100.

[3]Variable transformed by multiplying the variance by 1000.

one of the indicators of each of the exogenous variables (See Jöreskog & Sörbom, 1981).

Fink and Monge (1985) note that factor analysis cannot create theoretically meaningful variables from indicators that are only weakly related. Fink (1980) proposes that:

> . . . each indicator of the same unobserved variable be required to reflect theoretically equivalent operations (or operations that may be transformed to equivalence), and that these operations consist of fundamental or derived measurements. (p.136)

Fink's (1980) concern for congeneric measurement was explored with the two measurement submodels (see Bagozzi, 1980). A review of the endogenous measurement submodel revealed that the correlation between the two endogenous indicators y_1, number of times information was transfered in the past, and y_2, probability of future information transfer, was –.0678. This low correlation indicates that these two indicators of η_1 (likelihood of information transfer) do not measure the same endogenous variable. The first modification to the model was to separate the two endogenous indicators into two endogenous variables with one indicator each. The two indicators are measures of past information transfer (y_1) and future information transfer (y_2). The two endogenous variables η_1 and η_2 will use the same labels as their respective indicators for purposes of discussion.

The exogenous measurement submodel was assessed to determine whether the indicators for each of the exogenous variables was appropriately specified and if modifications to the submodel were necessary. Figure 6 is a representation of the relationships in the original exogenous measurement submodel. Note that the exogenous

measurement submodel was specified with three exogenous variables. The first exogenous variable ξ_1 (Access to information) had two indicators x_1 (formal network location) and x_2 (Informal network location), the second exogenous variable ξ_2, (relational propensity/tie strength) had three indicators x_3 (closeness), x_4 (frequency of communication), x_5 (symmetry) and the third exogenous variable ξ_3 (information value) had two indicators x_6 (information value to others) and x_7 (information value to self). The exogenous variables were allowed to covary.

Two modifications to the exogenous measurement submodel were necessary. Symmetry, x_5, was considered an indicator of both ξ_1, access to information, and ξ_3, information value. Figure 8 graphically illustrates these modifications. This was plausible since the degree to which the relationship between dyads members is two way might have an effect on the dyads access to information and the way information was valued. A χ^2 of 16.3 with 9 degrees of freedom was obtained and $p \leq .061$. This is considered an acceptable fit, especially considering the large size of the sample used. Table 6 provides the parameter estimates of the measurement submodel. Jöreskog and Sörbom's (1981) recommendation for assigning a unit of measurement was adhered to by fixing a one in each column of the Λ_X matrix. This defined the unit of measurement to be the same as in one of the observed variables and allowed for estimation. The reliabilities (squared multiple correlations) for the seven indicators are noted in Table 7.

The goal of this modification procedure was to modify the original model so that it continued to have theoretical validity and could be tested empirically.

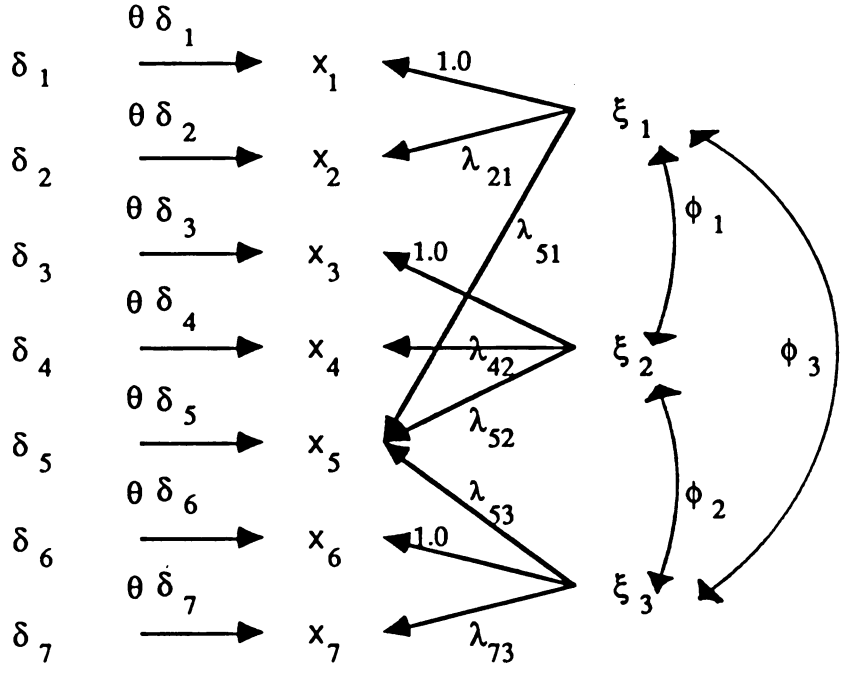


Figure 8. Modified Exogenous Measurement Model with Three Exogenous Variables and Seven Indicators

Glossary

X_1	Access in the formal network	ξ_1	Access to Information
X_2	Access in the informal network	ξ_2	Relational propensity/strength of tie
X_3	Closeness	ξ_3	Information value
X_4	Frequency of communication		
X_5	Symmetry		
X_6	Information value for others		
X_7	Information value for self		

Table 6. Parameter Estimates with Standard Errors for the Modified (Exogenous) Measurement Submodel.

Parameter	Parameter Estimate (ML)	Standard Error
λ_{11}	1.000*	
λ_{21}	−1.286	(0.245)
λ_{32}	1.000*	
λ_{42}	5.206	(1.973)
λ_{51}	−0.154	(0.142)
λ_{52}	0.246	(0.126)
λ_{53}	0.264	(0.060)
λ_{63}	1.000*	
λ_{73}	1.314	(0.127)
ϕ_1	−64.363	(27.787)
ϕ_2	−48.987	(28.826)
ϕ_3	496.919	(64.889)
$\theta\delta_1$	361.239	(82.518)
$\theta\delta_3$	670.303	(69.973)
$\theta\delta_4$	198.152	(1683.668)
$\theta\delta_5$	1477.752	(80.411)
$\theta\delta_6$	2165.897	(183.944)
$\theta\delta_7$	693.940	(250.700)

* These parameter values were fixed for scaling purposes.

$\chi^2 = 16.30$; 9 df; $p \leq 0.061$
Coefficient of Determination (generalized reliability) for x variables = 0.996.

Figure 9 illustrates the modifications made to the original model based on the results of the analyses of the two measurement submodels. This model will be referred to as Model 1. Note that each of the endogenous variables, transfer of information in the past, η_1, and transfer of information in the future, η_2, is predicted by the three exogenous variables

Table 7. Reliabilities for x Variables

Observed Variable	Reliability*
x_1	0.549
x_2	0.119
x_3	0.195
x_4	0.957
x_5	0.060
x_6	0.433
x_7	0.804

* Squared multiple correlations

Coefficient of Determination (generalized reliability) for x variables = 0.996.

ξ_1, access to information, ξ_2, relational propensity/strength of tie, and ξ_3, information value. The revised structural equations for the theoretical and

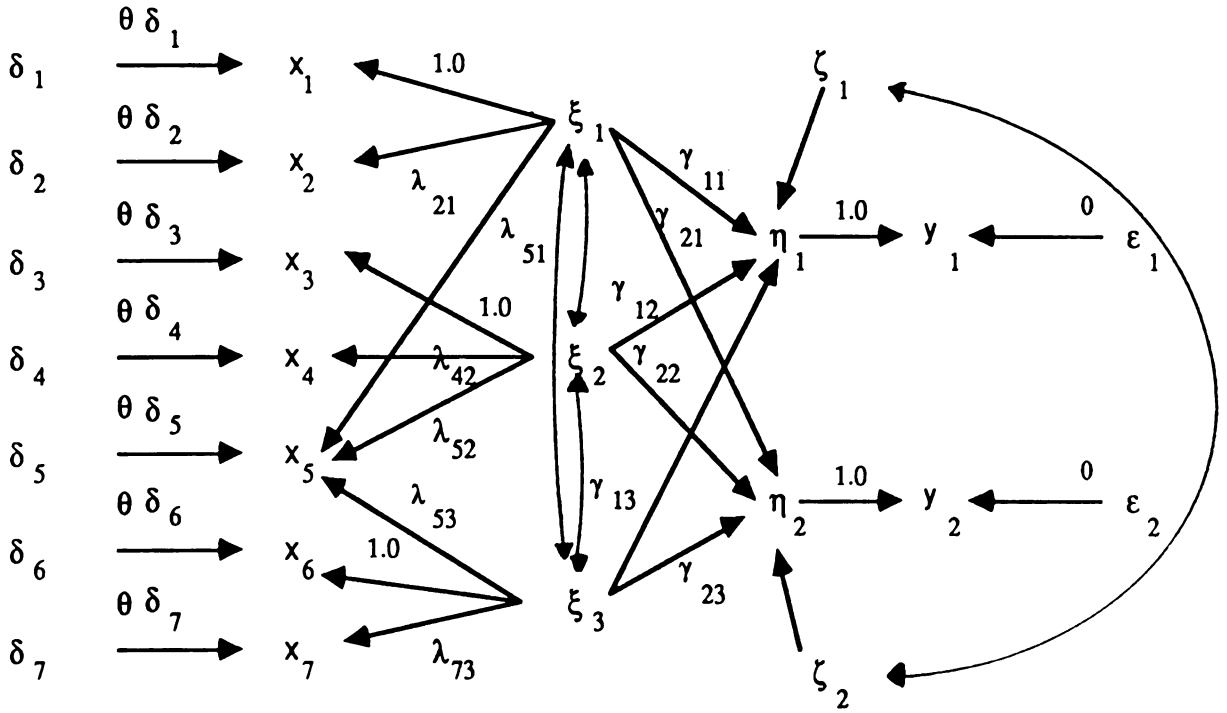


Figure 9. Full Model (1) of Information Transfer in Organizational Dyads

Glossary

X_1	Access in the formal network	ξ_1	Access to Information
X_2	Access in the informal network	ξ_2	Relational propensity/strength of tie
X_3	Closeness	ξ_3	Information value
X_4	Frequency of communication	y_1	Number of times information transferred in the past
X_5	Symmetry	y_2	Probability of future information transfer
X_6	Information value for others	η_1	Information transfer in the past
X_7	Information value for self	η_2	Information transfer in the future

measurement model as depicted in Figure 9 are written as:

The theoretical submodel

$$\begin{pmatrix} \eta_1 \\ \eta_2 \end{pmatrix} = \begin{pmatrix} \gamma_{11} & \gamma_{12} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} \end{pmatrix} \begin{pmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \end{pmatrix} + \begin{pmatrix} \zeta_1 \\ \zeta_2 \end{pmatrix} \quad (15)$$

The measurement submodel

$$\begin{pmatrix} y_1 \\ \\ y_2 \end{pmatrix} = \begin{pmatrix} \lambda_1 & 0 \\ \\ 0 & \lambda_2 \end{pmatrix} \begin{pmatrix} \eta_1 \\ \\ \eta_2 \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \\ \varepsilon_2 \end{pmatrix} \quad (16)$$

Note that the $\Theta\varepsilon$ matrix will be a null matrix since it is assumed there is no error in the measures of y_1 and y_2. $\Theta\varepsilon$ will not be estimated.

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ \lambda_{21} & 0 & 0 \\ 0 & 1 & 0 \\ 0 & \lambda_{42} & 0 \\ \lambda_{51} & \lambda_{52} & \lambda_{53} \\ 0 & 0 & 1 \\ 0 & 0 & \lambda_{73} \end{pmatrix} \begin{pmatrix} \xi_1 \\ \\ \xi_2 \\ \\ \xi_3 \end{pmatrix} + \begin{pmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \\ \delta_4 \\ \delta_5 \\ \delta_6 \\ \delta_7 \end{pmatrix} \quad (17)$$

This full model as specified meets the necessary condition for over identification according to the counting rule, with 17 over identifying restrictions (Bagozzi, 1980; Jöreskog & Sörbom, 1977). Table 8 provides the parameter estimates, standard errors and the standardized estimates for Model 1. Standardized estimates are provided. These parameter estimates are created by standardizing the ξs and ηs so they have unit variance. The covariance of standardized measures is the correlation (Kenny, 1979). These estimates should, however, be used cautiously since there is a loss of the

Table 8. Parameter Estimates with Standard Errors and Standardized Estimates for Model 1.

Parameter	Parameter Estimate (ML)	Standard Error	Standardized Estimates
λ_{11}	1.000*		20.634
λ_{21}	−1.333	(0.243)	−27.503
λ_{51}	−0.163**	(0.136)	−3.503
λ_{32}	1.000*		24.210
λ_{42}	1.445	(0.146)	34.992
λ_{52}	0.100**	(0.070)	2.426
λ_{53}	0.265	(0.060)	10.588
λ_{63}	1.000*		39.950
λ_{73}	1.362	(0.130)	54.425
γ_{11}	−0.419	(0.187)	−0.186
γ_{12}	0.136**	(0.087)	0.071
γ_{13}	0.239	(0.075)	0.206
γ_{21}	0.304	(0.106)	0.242
γ_{22}	0.703	(0.070)	0.655
γ_{23}	−0.053**	(0.039)	−0.082
ϕ_{11}	425.675	(83.350)	1.000
ϕ_{21}	−78.052	(29.428)	−0.156
ϕ_{31}	479.427	(63.466)	0.582
ϕ_{22}	586.128	(65.606)	1.000
ϕ_{32}	−114.124	(47.063)	−0.118
ϕ_{33}	1596.053	(213.749)	1.000
ψ_{11}	2081.487	(115.024)	0.962
ψ_{21}	−110.166	(40.878)	−0.068
ψ_{22}	381.482	(33.968)	0.000
$\theta\delta_1$	376.127	(77.046)	
$\theta\delta_2$	5361.919	(313.744)	
$\theta\delta_3$	246.396	(51.945)	
$\theta\delta_4$	339.789	(207.352)	
$\theta\delta_5$	1487.308	(80.710)	
$\theta\delta_6$	2223.333	(180.230)	
$\theta\delta_7$	584.768	(254.644)	

* This parameter value was fixed for scaling purposes.

** This parameter estimate may not be significantly different from zero since the t value is less than 2.

$n = 713$

$\chi^2 = 117.12$; 17 df; $p \leq 0.001$

variances in the data which "results in an inability to compare data from samples drawn from populations that differ with respect to variances" (Fink, 1980, p.135).

The χ^2 is 117.12 with 17 degrees of freedom and $p \leq .0001$. The χ^2 goodness of fit test of the modified model of information transfer assessed whether the set of restrictions implied by the model and its parameters could be reproduced by the observed data. This test indicates that the model is a poor fit to the data. However, since the sample size is large, caution must be taken and closer scrutiny is needed. Fink (1980) comments that:

> The proposed χ^2 - test is best used cautiously (Jöreskog,1974, p.4); research on the statistical power of this test should be done so that this, too, may be taken into account when evaluating a model. Nevertheless, statistical techniques should be the servants, not the masters, in the theory building process; given the large number of ways a model may be evaluated, judgment rather than reflex is what is required. (p.137)

Jöreskog & Sörbom (1981) propose looking at the following quantities :

1. Parameter estimates
2. Standard errors when using maximum likelihood methods(ML)
3. Squared multiple correlations
4. Coefficients of determination
5. Correlations of parameter estimates (for ML only)

to judge the goodness of fit of a model. They caution that these measures do not express the quality of the model as judged by other internal or external criteria. As noted earlier, unusual parameter estimates such as correlations over 1 or negative variances are a clue to misspecification. Standard errors that are large relative to the parameter estimates are also a useful indication of misspecification. The parameter estimate divided by its standard error is its t value. The t values are used to assess whether a parameter is significantly different from zero. If the t value is greater than 2 then the parameter is judged to be significantly different from zero. Squared multiple correlations and coefficients of determination provide additional information about the

goodness of fit of the model. These measures are given for the observed variables as well as the structural equations. The squared multiple correlation is a measure of the strength of relationship between two variables. For the observed variables, the squared multiple correlations measures show how well the indicators serve as measures of the latent variables. It is an indication of reliability. The coefficient of determination is a measure of the strength of several relationships jointly. Its range is from zero to one. Large values of the coefficient of determination are associated with good models. All of these methods are useful for determining problems with a model.

For Model 1, the total coefficient of determination for the x variables is .98, which is very high. The squared multiple correlation for the structural equations is .04 for the first equation, predicting information transfer in the past, and .43 for the second equation, predicting future information transfer. The total coefficient of determination for the structural equations is .46. This indicates that the first equation, in which information transfer in the past is predicted by access to information, relational propensity/tie strength and information value, is a poor representation of the relationships. The second equation, in which information transfer in the future is predicted by access to information, relational propensity/tie strength and information value, has greater explanatory power but still is not more than a moderate explanation of the relationships. The total coefficient of determination also indicates that the model is only a fair explanation of the relationships.

The next step was to determine if further modification to Model 1 was appropriate and what it should be. The procedure used modified the links in the model in a step by step fashion (see Miller & Monge, 1985). First, insignificant links were removed. This was done to make the model more parsimonious and still retain a good fit to the data.

The t values were examined for indications of the links that were not significant. After all the insignificant links were removed, then links were added that appeared to be conceptually consistent with the model. Modification indices were used as indicators of where additional links might be added. These indices also provided estimates of the degree to which the addition of the link would affect χ^2. LISREL provided the t values and modification indices.

Five modifications were sequentially made to Model 1. Each modification is considered a new model. These modified models correspond to Model 2 through Model 6. Table 9 presents a summary of these modifications and corresponding χ^2 statistics and degrees of freedom. Model 2 removes the link from ξ_1, access to information, to x_5, symmetry. Figure 10 is a representation of Model 2. Table 10 presents the parameter estimates, standard errors and standardized estimates for Model 2. The χ^2 was 118.65 with 18 degrees of freedom. Model 3 removes the link from ξ_2, relational propensity/ strength of tie, to η_1, information transfer in the past. Figure 11 is a representation of Model 3. Table 11 presents the parameter estimates, standard errors and standardized estimates for Model 3. The χ^2 was 120.85 with 19 degrees of freedom. Model 4 removes the link from ξ_3, information value, to η_2, information transfer in the future. Figure 12 is a representation of Model 4. Table 12 presents the parameter estimates, standard errors and standardized estimates for Model 4. The χ^2 was 123.38 with 20 degrees of freedom. Model 5 removes the link from ξ_2, relational propensity/ strength of tie, to x_5, symmetry. Figure 13 is a representation of Model 5. Table 13 presents the parameter estimates, standard errors and standardized estimates for Model 5. The

Table 9. Modifications Made to the Original Model of Information Transfer in Organizational Dyads.

Model Name	Modifications to Previous Model	χ^2/df
Model 1	Two single indicator endogenous variables, η_1, transfer of information in the past, and η_2,transfer information in the future, were substituted for η_1, likelihood of information transfer. All three exogenous variables predict each of the endogenous variables.	117.12/17
Model 2	Path from ξ_1, access to information, to x_5, symmetry, removed.	118.65/18
Model 3	Path from ξ_2, relational propensity/ tie strength, to η_1, information transfer in the past, removed.	120.85/19
Model 4	Path from ξ_3, information value, to η_2, information transfer in the future, removed.	123.38/20
Model 5	Path from ξ_2, relational propensity/tie strength to x_5, symmetry, removed.	123.38/21
Model 6	Path from ξ_1, access to information to x_3, closeness, added.	110.16/20

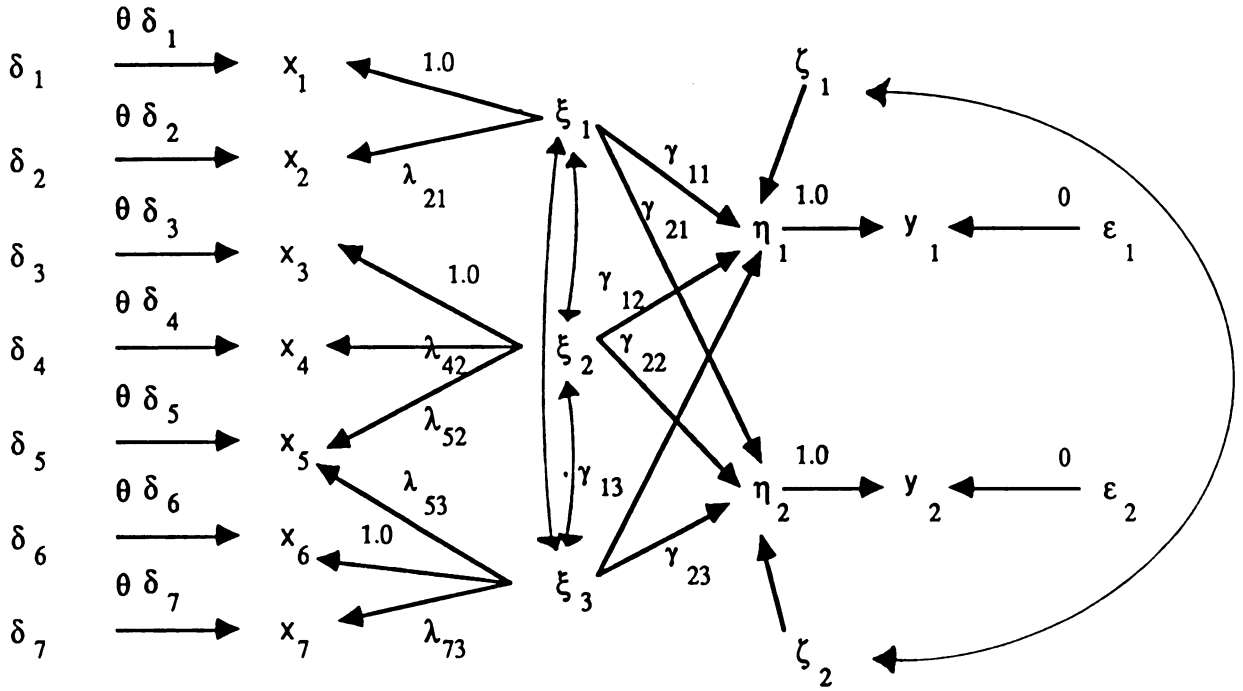


Figure 10. Full Model (2) of Information Transfer in Organizational Dyads

Glossary

X_1	Access in the formal network	ξ_1	Access to Information
X_2	Access in the informal network	ξ_2	Relational propensity/strength of tie
X_3	Closeness	ξ_3	Information value
X_4	Frequency of communication	y_1	Number of times information transferred in the past
X_5	Symmetry	y_2	Probability of future information transfer
X_6	Information value for others	η_1	Information transfer in the past
X_7	Information value for self	η_2	Information transfer in the future

Table 10. Parameter Estimates with Standard Errors and Standardized Estimates for Model 2.

Parameter	Parameter Estimate (ML)	Standard Error	Standardized Estimates
λ_{11}	1.000*		20.316
λ_{21}	−1.372	(0.246)	−27.877
λ_{32}	1.000*		24.261
λ_{42}	1.440	(0.146)	34.935
λ_{52}	0.110**	(0.069)	2.668
λ_{53}	0.214	(0.041)	8.473
λ_{63}	1.000*		39.611
λ_{73}	1.387	(0.135)	54.937
γ_{11}	−0.467	(0.198)	−0.204
γ_{12}	0.132**	(0.087)	0.067
γ_{13}	0.255	(0.077)	0.217
γ_{21}	0.305	(0.107)	0.238
γ_{22}	0.700	(0.069)	0.654
γ_{23}	−0.052**	(0.039)	−0.080
ϕ_{11}	412.751	(80.875)	1.000
ϕ_{21}	−77.045	(29.340)	−0.156
ϕ_{22}	588.611	(65.909)	1.000
ϕ_{31}	468.765	(62.986)	0.582
ϕ_{32}	−14.568	(46.466)	−0.119
ϕ_{33}	1569.030	(213.072)	1.000
ψ_{11}	2071.461	(115.664)	0.957
ψ_{21}	−106.912	(41.095)	−0.088
ψ_{22}	383.211	(33.915)	0.568
$\theta\delta_1$	389.049	(74.235)	
$\theta\delta_2$	5341.382	(313.743)	
$\theta\delta_3$	243.914	(52.262)	
$\theta\delta_4$	3373.732	(207.552)	
$\theta\delta_5$	1498.128	(80.210)	
$\theta\delta_6$	2250.348	(181.309)	
$\theta\delta_7$	528.788	(263.072)	

* This parameter value was fixed for scaling purposes.

** This parameter estimate may not be significantly different from zero since the t value is less than 2.

$n = 713$

$\chi^2 = 118.65$; 18 df; $p \leq 0.001$

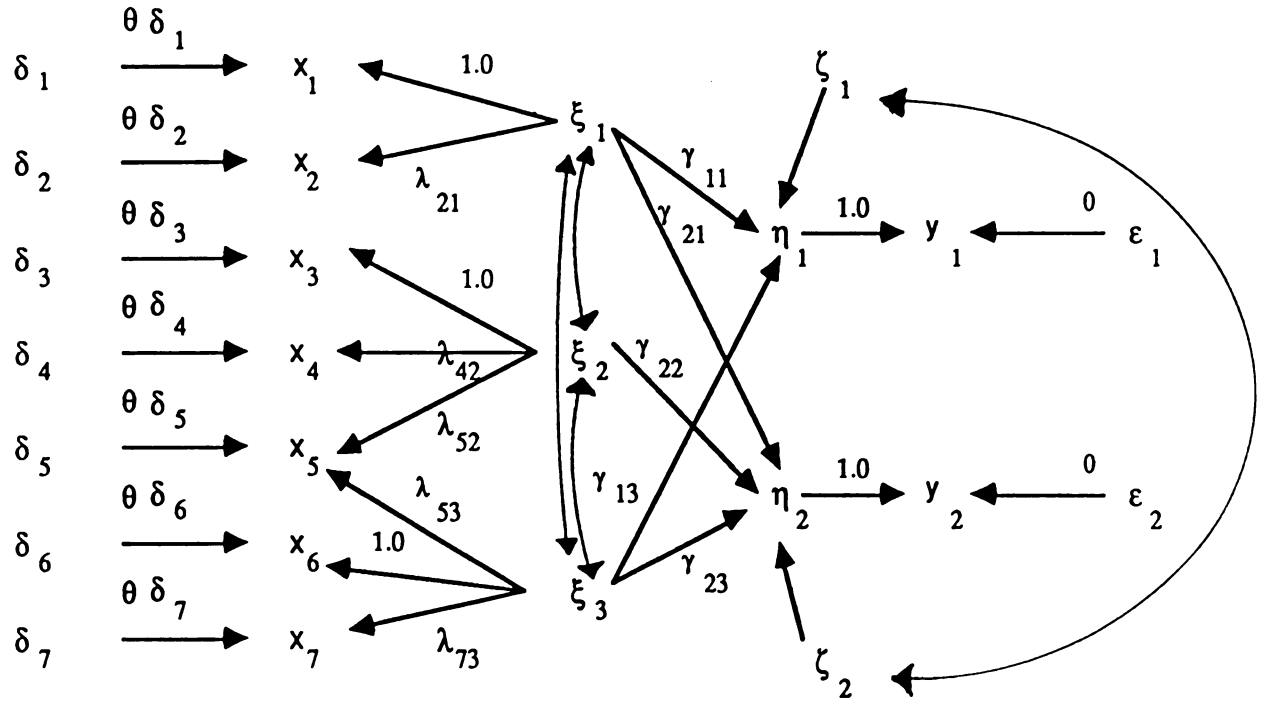


Figure 11. Full Model (3) of Information Transfer in Organizational Dyads

Glossary

X_1	Access in the formal network	ξ_1	Access to Information
X_2	Access in the informal network	ξ_2	Relational propensity/strength of tie
X_3	Closeness	ξ_3	Information value
X_4	Frequency of communication	y_1	Number of times information transferred in the past
X_5	Symmetry	y_2	Probability of future information transfer
X_6	Information value for others	η_1	Information transfer in the past
X_7	Information value for self	η_2	Information transfer in the future

Table 11. Parameter Estimates with Standard Errors and Standardized Estimates for Model 3.

Parameter	Parameter Estimate (ML)	Standard Error	Standardized Estimates
λ_{11}	1.000*		19.575
λ_{21}	−1.459	(0.248)	−28.564
λ_{32}	1.000*		24.508
λ_{42}	1.410	(0.146)	34.563
λ_{52}	0.110**	(0.068)	2.708
λ_{53}	0.213	(0.041)	8.492
λ_{63}	1.000*		39.802
λ_{73}	1.374	(0.227)	−0.254
γ_{11}	−0.604	(0.227)	−0.254
γ_{13}	0.284	(0.084)	0.243
γ_{21}	0.328	(0.116)	0.246
γ_{22}	0.697	(0.070)	0.656
γ_{23}	−0.059**	(0.041)	−0.091
ϕ_{11}	383.166	(73.643)	1.000
ϕ_{21}	−80.586	(28.819)	−0.168
ϕ_{22}	600.642	(67.807)	0.602
ϕ_{31}	468.887	(62.807)	0.602
ϕ_{32}	−111.842	(46.826)	−0.115
ϕ_{33}	1584.207	(213.817)	1.000
ψ_{11}	2057.049	(118.552)	0.951
ψ_{21}	−85.426	(40.353)	−0.071
ψ_{22}	384.965	(34.585)	0.568
$\theta\delta_1$	418.638	(67.838)	
$\theta\delta_2$	5302.648	(312.885)	
$\theta\delta_3$	231.881	(53.986)	
$\theta\delta_4$	3399.667	(208.514)	
$\theta\delta_5$	1497.482	(80.203)	
$\theta\delta_6$	2235.189	(181.131)	
$\theta\delta_7$	556.546	(259.203)	

* This parameter value was fixed for scaling purposes.

** This parameter estimate may not be significantly different from zero since the t value is less than 2.

$n = 713$

$\chi^2 = 120.85$; 19 df; $p \leq 0.001$

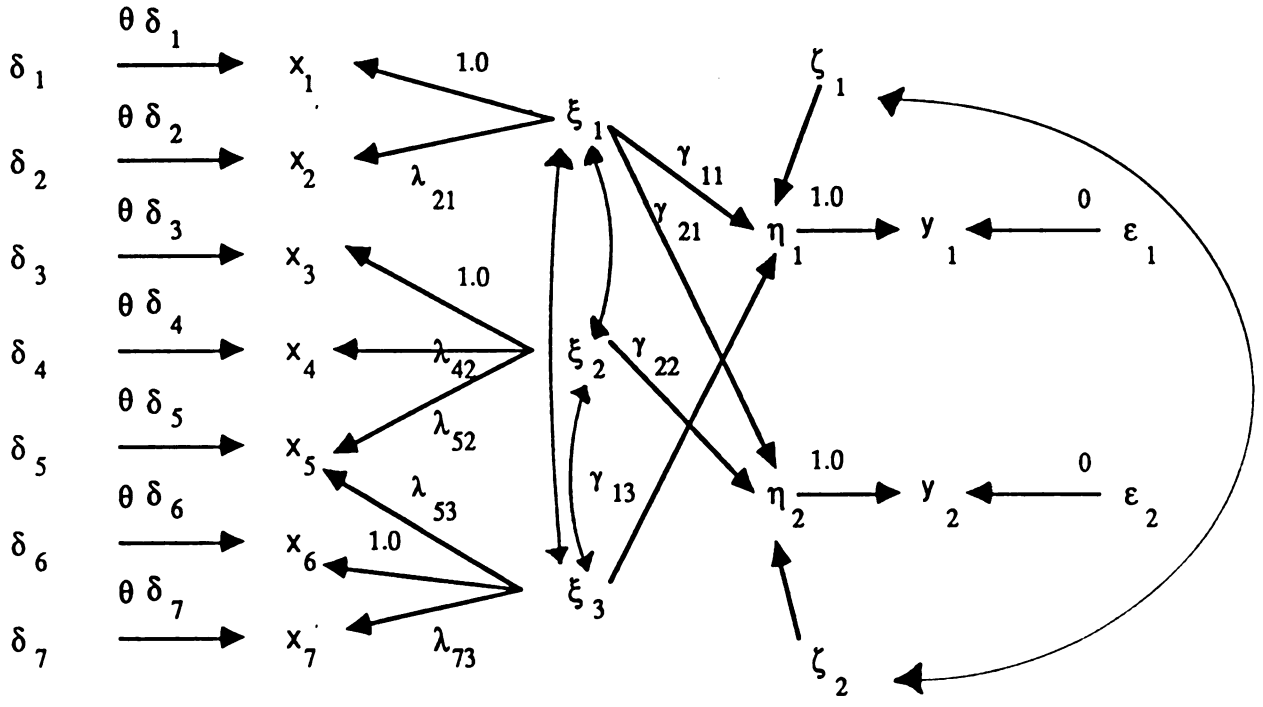


Figure 12. Full Model (4) of Information Transfer in Organizational Dyads

Glossary

X_1	Access in the formal network	ξ_1	Access to Information
X_2	Access in the informal network	ξ_2	Relational propensity/strength of tie
X_3	Closeness	ξ_3	Information value
X_4	Frequency of communication	y_1	Number of times information transferred in the past
X_5	Symmetry	y_2	Probability of future information transfer
X_6	Information value for others	η_1	Information transfer in the past
X_7	Information value for self	η_2	Information transfer in the future

Table 12. Parameter Estimates with Standard errors and Standardized Estimates for Model 4.

Parameter	Parameter Estimate (ML)	Standard Error	Standardized Estimates
λ_{11}	1.000*		20.442
λ_{21}	−1.394	(0.245)	−28.498
λ_{32}	1.000*		24.582
λ_{42}	1.399	(0.145)	34.401
λ_{52}	0.110**	(0.068)	2.695
λ_{53}	0.215	(0.041)	8.445
λ_{63}	1.000*		39.237
λ_{73}	1.413	(0.140)	55.460
γ_{11}	−0.468	(0.182)	−0.206
γ_{13}	0.238	(0.073)	0.201
γ_{21}	0.213	(0.060)	0.167
γ_{22}	0.690	(0.069)	0.651
ϕ_{11}	417.888	(77.520)	1.000
ϕ_{21}	−77.466	(29.200)	−0.154
ϕ_{22}	604.263	(67.814)	1.000
ϕ_{31}	454.235	(62.457)	0.566
ϕ_{32}	−123.550	(45.686)	−0.128
ϕ_{33}	1539.564	(212.331)	1.000
ψ_{11}	2083.136	(115.588)	0.964
ψ_{21}	−99.384	(38.288)	−0.082
ψ_{22}	394.495	(33.391)	0.582
$\theta\delta_1$	383.919	(70.934)	
$\theta\delta_2$	5306.425	(314.887)	
$\theta\delta_3$	228.264	(54.263)	
$\theta\delta_4$	3410.823	(208.5954)	
$\theta\delta_5$	1498.901	(80.194)	
$\theta\delta_6$	2279.858	(182.504)	
$\theta\delta_7$	0.867	(273.355)	

* This parameter value was fixed for scaling purposes.

** This parameter estimate may not be significantly different from zero since the t value is less than 2.

n = 713

$\chi^2 = 123.38$; 20 df; $p \leq 0.001$

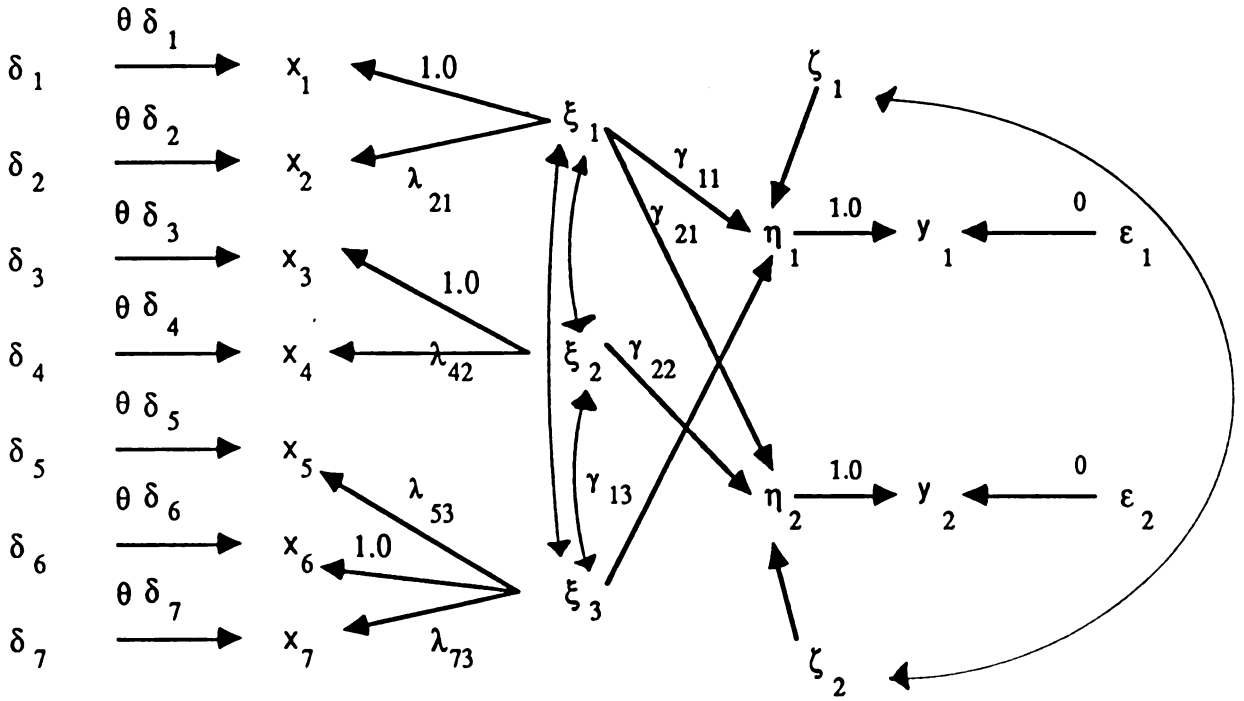


Figure 13. Full Model (5) of Information Transfer in Organizational Dyads

Glossary

X_1	Access in the formal network	ξ_1	Access to Information
X_2	Access in the informal network	ξ_2	Relational propensity/strength of tie
X_3	Closeness	ξ_3	Information value
X_4	Frequency of communication	y_1	Number of times information transferred in the past
X_5	Symmetry	y_2	Probability of future information transfer
X_6	Information value for others	η_1	Information transfer in the past
X_7	Information value for self	η_2	Information transfer in the future

Table 13. Parameter Estimates with Standard Errors and Standardized Estimates for Model 5 .

Parameter	Parameter Estimate (ML)**	Standard Error	Standardized Estimates
λ_{11}	1.000*		20.375
λ_{21}	−1.403	(0.246)	−28.581
λ_{32}	1.000*		24.558
λ_{42}	1.398	(0.146)	34.325
λ_{53}	0.205	(0.041)	8.073
λ_{63}	1.000*		39.303
λ_{73}	1.409	(0.140)	55.378
γ_{11}	−0.477	(0.184)	−0.209
γ_{13}	0.241	(0.073)	0.204
γ_{21}	0.213	(0.060)	0.167
γ_{22}	0.692	(0.069)	0.652
ϕ_{11}	415.151	(76.957)	1.000
ϕ_{21}	−76.886	(29.165)	−0.154
ϕ_{22}	603.119	(68.064)	1.000
ϕ_{31}	455.183	(62.613)	0.568
ϕ_{32}	−121.705	(45.724)	−0.126
ϕ_{33}	1544.764	(213.122)	1.000
ψ_{11}	2081.189	(115.715)	0.963
ψ_{21}	−100.338	(38.277)	−0.083
ψ_{22}	393.317	(33.584)	0.580
$\theta\delta_1$	386.652	(70.402)	
$\theta\delta_2$	5301.639	(314.860)	
$\theta\delta_3$	229.405	(54.602)	
$\theta\delta_4$	3415.991	(208.838)	
$\theta\delta_5$	1506.472	(80.435)	
$\theta\delta_6$	2274.615	(183.060)	
$\theta\delta_7$	480.110	(273.662)	

* These parameter values were fixed for scaling purposes.

** All parameter estimates are considered significant.

$n = 713$

$\chi^2 = 126.3$; 21 df; $p \leq 0.001$

χ^2 was 126.3 with 21 degrees of freedom. Note that all the parameter values are significant for Model 5 and it is the most parsimonious. Model 6 adds a link from ξ_1, access to information, to x_3, closeness.Figure 14 presents Model 6 . Table 14 presents the parameter estimates, standard errors and standardized estimates for Model 6. For Model 6, the χ^2 was 110.16 with 20 degrees of freedom. All links (paths) are significantly different from zero in this model. The total coefficient of determination for the x variables is .99, which is very high. The squared multiple correlation for the structural equations is .03 for the first equation, for transfer of information in the past, and .41 for the second equation, for transfer of information in the future. The total coefficient of determination for the structural equations is .43. This indicates that the first equation, in which past information transfer is predicted by access to information and information value, is a poor representation of the relationships. The second equation, in which future information transfer is predicted by access to information and relational propensity/ strength of tie, increases in explanatory power but still is not more than a moderate explanation of the relationships. The total coefficient of determination also indicates that the model is only a fair representation of the relationships.

Note that in all of the models (1 through 6), the hypothesized restricted covariance structure(matrix) as compared to the unrestricted covariance structure(matrix) was significantly different. This was indicated by a significant χ^2. This implies that each hypothesized model is not a good representation of the data. Model 5 and Model 6 were the only models with all links significantly different from zero.

Further examination of each model was necessary since the χ^2 statistic is highly

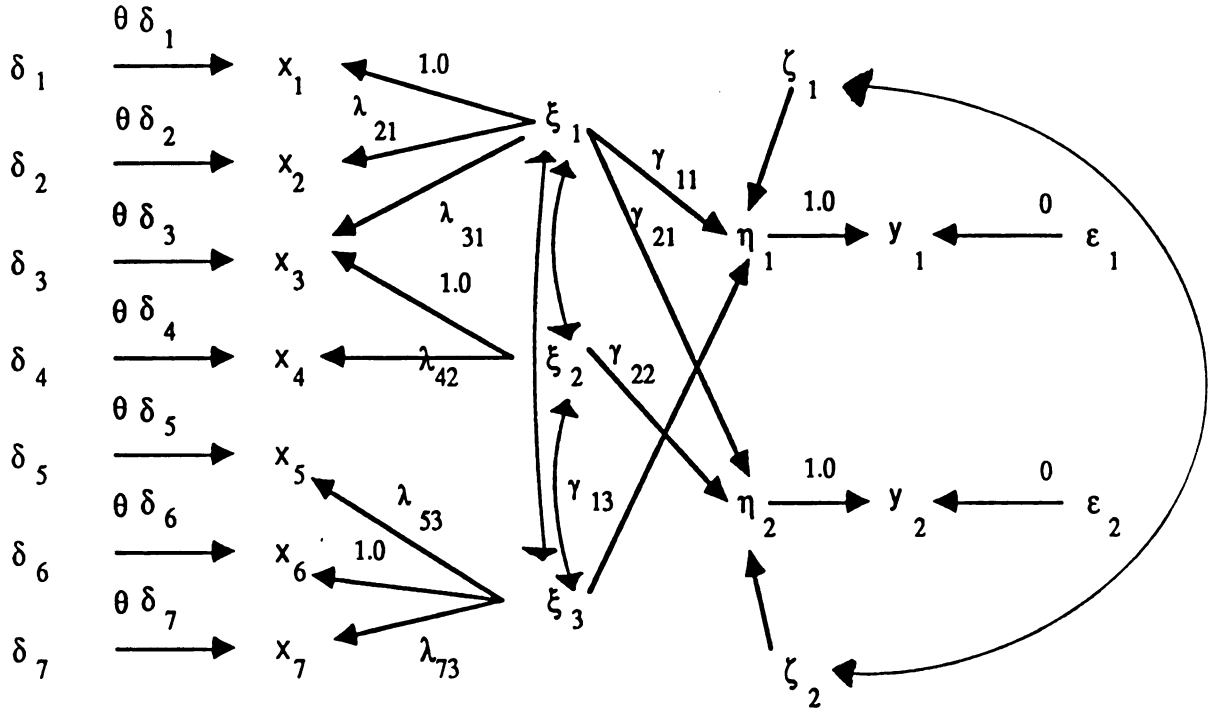


Figure 14. Full Model (6) of Information Transfer in Organizational Dyads

Glossary

X_1	Access in the formal network	ξ_1	Access to Information
X_2	Access in the informal network	ξ_2	Relational propensity/strength of tie
X_3	Closeness	ξ_3	Information value
X_4	Frequency of communication	y_1	Number of times information transferred in the past
X_5	Symmetry	y_2	Probability of future information transfer
X_6	Information value for others	η_1	Information transfer in the past
X_7	Information value for self	η_2	Information transfer in the future

Table 14. Parameter Estimates with Standard Errors and Standardized Estimates for Model 6 .

Parameter	Parameter Estimate (ML)**	Standard Error**	Standardized Estimates
λ_{11}	1.000*		21.407
λ_{21}	−1.286	(0.227)	−27.531
λ_{31}	0.416	(0.127)	8.906
λ_{32}	1.000*		27.392
λ_{42}	1.304	0.145)	35.721
λ_{53}	0.205	(0.041)	8.052
λ_{63}	1.000*		39.207
λ_{73}	1.419	(0.142)	55.515
γ_{11}	−0.419	(0.157)	−0.193
γ_{13}	0.224	(0.067)	0.189
γ_{21}	0.455	(0.104)	0.374
γ_{22}	0.670	(0.070)	0.704
ϕ_{11}	458.267	(80.362)	1.000
ϕ_{21}	−249.625	(61.171)	−0.426
ϕ_{22}	750.302	(107.666)	1.000
ϕ_{31}	451.721	(62.628)	0.538
ϕ_{32}	−290.120	(77.073)	−0.270
ϕ_{33}	1537.166	(213.573)	1.000
ψ_{11}	2088.331	(114.546)	0.966
ψ_{21}	−99.240	(38.097)	−0.082
ψ_{22}	398.984	(34.524)	0.588
$\theta\delta_1$	343.534	(72.906)	
$\theta\delta_2$	5360.522	(313.202)	
$\theta\delta_3$	210.607	(58.974)	
$\theta\delta_4$	3318.229	(207.150)	
$\theta\delta_5$	1506.089	(80.441)	
$\theta\delta_6$	2282.209	(184.114)	
$\theta\delta_7$	464.920	(278.413)	

* These parameter values were fixed for scaling purposes.

** All parameter estimates are considered significant.

n = 713

$\chi^2 = 110.16$; 20 df; $p \leq 0.001$

sensitive to very large sample size. An n of 713 is considered very large. A χ^2 / df ratio test (Wheaton et al., 1977) was used as a more appropriate test of significance for the sample. All ratio values of 5 or less were considered to represent an acceptable fit of the model to the data.

Two additional tests of the models were done. The first procedure entailed a series of χ^2 difference tests. This required the specification of a null model with which the six models are compared. Then the models are hierarchically arranged and compared to ascertain the degree to which each subsequent modification to the model provided a better fit to the data. The second procedure assessed practical differences between each of the models and the null model as well as comparisons between the hierarchically arranged models. Two indices of fit, ρ, the non normed fit index, and Δ,the normed fit index were calculated (Bentler & Bonnett, 1980). Fink and Monge (1985) believe that the normed fit index is especially valuable for assessing the fit of models in which the sample size is large.

> Given the sensitivity of χ^2 to large sample size , it is entirely possible to obtain a χ^2 value comparing our hypothesized model to the saturated model which is significant (which means the data do not fit the hypothesized model), and a normed incremental fit index value which shows that there is relatively little unexplained fit remaining to be explained (say 5%-10%). Such a result should lead the researcher to conclude that the maintained model is quite good despite the significant χ^2 value. (p.186)

Table 15 presents the χ^2 goodness of fit test statistic, degrees of freedom, and the ratio of χ^2 to degrees of freedom for the null model and the six alternative models. The Null model and each of the six alternative models (M_1 to M_6) have χ^2 values that are statistically significant. This implies that the models are not a good representation of the data. By definition, the null model is expected to be inadequate. In all seven cases the χ^2/df ratios were greater than 5 which is also cause for not accepting the models as a

TABLE 15. Model Test of the Null and Six Alternative Models of Information Transfer in Organizational Dyads.

	Model test		
	χ^2	df	χ^2/df
M_0	1066.56*	36	29.63
M_1	117.12*	17	6.80
M_2	118.65*	18	6.59
M_3	120.85*	19	6.36
M_4	123.38*	20	6.17
M_5	126.21*	21	6.01
M_6	110.16*	20	5.50

Note: M_0 = Null model. M_1 = Original model modified with findings from examination of the measurement submodels. M_2= Model 1 minus insignificant link from ξ_1 to x_5. M_3 = Model 2 minus insignificant link from ξ_2 to η_1. M_4 = Model 3 minus insignificant link from ξ_3 to η_2. M_5 = Model 4 minus insignificant link from ξ_2 to x_5. M_6 = Model 5 with link from ξ_1 to x_3 added.

n = 713

* $p \leq .001$

TABLE 16. Model Comparison of the Null and the Six Alternative Models of Information Transfer in Organizational Dyads.

	Model Comparison			
Comparison	χ^2d	df_d	ρ	Δ
M_0 - M_1	949.44*	19	0.797	0.890
M_0 - M_2	947.91*	18	0.805	0.889
M_0 - M_3	945.71*	17	0.813	0.887
M_0 - M_4	943.18*	16	0.819	0.884
M_0 - M_5	940.35*	15	0.825	0.882
M_0 - M_6	956.40*	16	0.843	0.900
M_2 - M_1	1.53	1	0.007	0.001
M_3 - M_2	2.20	1	0.008	0.002
M_4 - M_3	2.53	1	0.006	0.002
M_5 - M_4	2.36	1	0.006	0.002
M_5 - M_6	15.55*	1	0.018	0.015

n = 713 $\quad \rho = ((Q_k - Q_l)/Q_0 - 1) \quad Q = \chi^2/df$

* $p \leq .001$ $\quad \Delta = (\chi^2_k - \chi^2_l)/\chi^2_0$

good fit to the data.

Table 16 presents the model comparisons. A χ^2 difference value, degrees of freedom difference value and the two fit indices are provided. The table provides three indicators of fit, the χ^2 difference test, and the two fit indices, ρ, the non normed fit index, and Δ, the normed fit index. First, each model is compared to the null model and then the hierarchically arranged models are compared. In the hierarchically arranged comparisons each model is compared to the previous model from which it was derived to ascertain if the change in fit is significant.

The test of the equality of parameters between the null model and each of the six models is rejected at the .001 level. The rejection of the null model at the $p \leq .001$ level implies that within sampling error the hypothesized structure better explains the relationships in the observed data than a structure in which relationships among the variables are not specified (see Fink & Monge,1985). Model 1 is not a significantly better fit to the data than the hierarchically arranged models. Model 5 is the most parsimonious model having the fewest links. It also is a desirable model since all the links were significantly different from zero.

Model 6, of all the models, provides the best fit. The difference between Model 5 and Model 6 is statistically significant with $\chi^2_d = 15.55$ and $p \leq .001$. Model 6 is a significant improvement in fit over Model 5 and can be considered to provide the best fit to the data. Note that for Model 6 the χ^2/df ratio was smallest at 5.50, and its fit indices were good at $\rho_{06} = .843$ and $\Delta_{06} = .90$. This indicates that only 10% of the potential fit in the data could be explained by improvements that could be made to the model. The improvement in fit between Model 5 and Model 6, though significant, is rather small in terms of the potential fit in the data. Only 1.5% of the potential fit is explained by Model 6 as compared to Model 5. The results of this analysis indicate that Model 6 is statistically better than the null model, accounts for a large proportion of the

fit to the unrestricted model, and provides a better fit than the originally modified model and the 5 other alternative models. The improvement in fit is, however, small. It is also apparent that while a better fit could be achieved by modifications to Model 6, it is relatively small compared to what has been explained.

Table 17 presents a summary of the hypothesis test results for the six models of information transfer in organizational dyads. For the hierarchically arranged models the fit indices indicate the direction of the change in fit with "+" indicating an increase in fit and "–" a decrease in fit. Although a model has been obtained that provides a good fit to the data, it should be tested and validated with new data before it is fully accepted.

This section has presented the results of the test of the original model of information transfer in organizational dyads. The model could not be tested without modification which led to the development of a series of hierachically nested models. Model 6 which is pictured in Figure 15 was considered the best fitting model to the data. All of the paths in this model were considered significant. The results of the analysis indicate, contrary to expectations, a negative relationship between access to information and past information transfer and, as was proposed, a positive relationship between information value and past information transfer. A positive relationship between access to information and future information transfer was indicated, as well as a positive relationship between relational propensity/ strength of tie and future information transfer.

5.4 Comparison of Bridging Conditions

The influence of bridging and non bridging conditions on the transfer of information was the focus of this analysis. The procedures used to test the effect of bridging conditions on information transfer differed from what was originally planned since the original model of information transfer in organizational dyads was not accepted and

Table 17. Summary of Hypothesis Tests for All Models

Hypothesis	Models	Model Test Results		
		χ^2 goodness of fit	χ^2/df	
H_6	M_1	Cannot Reject	Cannot Reject	
H_0: $\Sigma_R = \Sigma_U$	M_2	Cannot Reject	Cannot Reject	
	M_3	Cannot Reject	Cannot Reject	
H_A: $\Sigma_R \neq \Sigma_U$	M_4	Cannot Reject	Cannot Reject	
	M_5	Cannot Reject	Cannot Reject	
	M_6	Cannot Reject	Cannot Reject	
		χ^2 different test	Fit Indices*	
			ρ**	Δ**
H_7	M_1	Reject	Reject	Reject
H_0: $\Sigma_R = \Sigma_0$	M_2	Reject	Reject	Reject
	M_3	Reject	Reject	Reject
H_A: $\Sigma_R \neq \Sigma_0$	M_4	Reject	Reject	Reject
	M_5	Reject	Reject	Reject
	M_6	Reject	Reject	Reject
H_0:	M_1 - M_2	Cannot Reject	+	-
$\Sigma_{Mi} = \Sigma_{Mj}$	M_2 - M_3	Cannot Reject	+	-
H_A:	M_3 - M_4	Cannot Reject	+	-
$\Sigma_{Mi} \neq \Sigma_{Mj}$	M_4 - M_5	Cannot Reject	+	-
	M_5 - M_6	Reject	+	+

* Fit indices are practical tests of the hypothesis.

** For the hierarchical model, (-) indicates decrease and (+) indicates an increase in model fit.

therefore could not be tested under the different bridging conditions. The purpose of the analysis of different bridging and non bridging conditions is to determine whether there are differences in the influence access to information, relational propensity/tie strength, and information value have on information transfer when dyads bridge or do not bridge different groups of organizational units. This is determined by a comparison of the parameter estimates for Γ, which is the matrix of coefficients for the ξ's on the η's. If the findings of the "'weak tie" thesis hold, one would expect that there would be a significant difference between the bridging and nonbridging dyads on $\xi 2$, relational propensity/ strength of tie as a predictor of information transfer.

An exploratory analysis of the bridging phenomenon will be presented in this section. Further tests of any of the findings with other data sets are necessary. Table 18 presents a breakdown of the number of dyads in each of the bridging and nonbridging conditions.

Table 18. Dyad Data Sets

	Formal Network Units	Informal Network Groups
Within (Non Bridging)	Non Boundary n = 581	Non Bridge n = 629
Between (Bridging)	Boundary n = 132	Bridge n = 84

As would be expected there were fewer bridging dyads relative to nonbridging dyads in

both the formal and informal network. The descriptive statistics for bridge, nonbridge, boundary and nonboundary dyads are presented in Appendix F. Table 19 is the matrix of correlations with standard deviations for bridge dyads. Table 20 is the matrix of correlations with standard deviations for nonbridge dyads. Table 21 is the matrix of correlations with standard deviations for boundary dyads. Table 22 is the matrix of correlations with standard deviations for nonboundary dyads. The original model of information transfer in organizational dyads was not viable without modification. The same procedure used with all dyads (n=713) was used to obtain parameter estimates that could be compared between the different bridging dyads.

The first modification to all the dyad models was the separation of the endogenous variable η_1, likelihood of information transfer, into two endogenous variables η_1, information transfer in the past, and η_2, information transfer in the future. Confirmatory factor analyses for the exogenous measurement submodel was done for bridge, nonbridge, boundary and nonboundary dyads. The results were used to create full models of information transfer in organizational dyads that could be tested. Parameter estimates for bridge and nonboundary dyads were obtained. Parameter estimates for the nonbridge and boundary dyads could not be obtained using LISREL. The parameter estimates and standard errors for the model of information transfer using bridge dyads is presented in Table 23. The parameter estimates and standard errors for the model of information transfer using nonboundary dyads is presented in Table 24.

A procedure was used to obtained approximate estimates of the parameters in the nonbridge and boundary dyad models so a comparison could be made between the bridge and nonbridge dyad models and between the boundary and nonboundary dyad models. The procedure is not exact (e.g. , standard error estimates with LISREL are different from those obtained from regression analysis) but provided a gross estimate that allowed for

TABLE 19. Correlations and Standard Deviations (on the diagonal) among the Nine Indicators in the Model of Information Transfer in Organizational Dyads for Bridge Dyads. N = 84

		x_1	x_2	x_3	x_4	x_5	x_6	x_7	y_1	y_2
Formal Network Location[1]	x_1	31.0947*								
Informal network location[1]	x_2	-.1860	39.6059							
Closeness	x_3	-.2555	-.0459	33.1966						
Frequency of Communication	x_4	-.0735	-.0625	.4574	55.5447*					
Symmetry[3]	x_5	.0005	-.2367	.1679	.1641	47.4240*				
Information Value to Others[2]	x_6	.3238	-.2626	-.1562	-.1032	-.0082	61.9453*			
Information Value to Self[2]	x_7	.4490	-.1569	-.3268	-.2985	-.0465	.5849	60.1518*		
Information Transfer in the past[2]	y_1	.0967	.1441	.2859	.0771	-.0082	.0977	.0999	36.8234*	
Information Transfer in the future	y2	.0188	-.0646	.4720	.2624	-.0650	-.1758	-.2675	-.1494	24.5455

*Because of the arithmetic precision of the computer algorithm used, a linear transformation of this variable's variances and covariances was performed to allow LISREL to provide model estimates. This transformation has no effect on the results and tests of significance.

[1]Variable transformed by multiplying the variance by .01.

[2]Variable transformed by multiplying the variance by 100.

[3]Variable transformed by multiplying the variance by 1000.

TABLE 20. Correlations and Standard Deviations (on the diagonal) among the Nine Indicators in the Model of Information Transfer in Organizational Dyads for Non Bridge Dyads. N = 629

		x_1	x_2	x_3	x_4	x_5	x_6	x_7	y_1	y_2
Formal Network Location[1]	x_1	26.3882*								
Informal network location[1]	x_2	-.2674	79.7413*							
Closeness	x_3	.0254	-.0629	27.5621						
Frequency of Communication	x_4	-.0208	-.1366	.3934	59.3185					
Symmetry[3]	x_5	.0751	-.0828	-.0257	-.0484	35.6750*				
Information Value to Others[2]	x_6	.21525	-.1497	.0945	.0305	.1649	60.1104*			
Information Value to Self[2]	x_7	.2779	-.1835	-.0088	.0292	.2106	.5619	57.6670*		
Information Transfer in the past[2]	y_1	.0032	.2118	-.0653	.0961	-.1061	.08034	.1322	53.8449*	
Information Transfer in the future	y2	.1428	-.0571	.5749	.2122	-.0747	.0113	.0051	-.0767	24.4741

*Because of the arithmetic precision of the computer algorithm used, a linear transformation of this variable's variances and covariances was performed to allow LISREL to provide model estimates. This transformation has no effect on the results and tests of significance.

[1]Variable transformed by multiplying the variance by .01.

[2]Variable transformed by multiplying the variance by 100.

[3]Variable transformed by multiplying the variance by 1000.

TABLE 21. Correlations and Standard Deviations (on the diagonal) among the Nine Indicators in the Model of Information Transfer in Organizational Dyads for Boundary Dyads. N = 132

		x_1	x_2	x_3	x_4	x_5	x_6	x_7	y_1	y_2
Formal Network Location[1]	x_1	33.1957*								
Informal network location[1]	x_2	-.1150	49.2224*							
Closeness	x_3	-.2126	.0824	33.6965						
Frequency of Communication	x_4	-.0210	.0980	.5098	53.6095					
Symmetry[3]	x_5	-.1037	-.0524	.0688	.1596	43.8960*				
Information Value to Others[2]	x_6	.2792	-.1072	-.1003	-.1294	-.1382	53.5762*			
Information Value to Self[2]	x_7	.4322	-.0223	-.2708	-.3001	-.0903	.5280	55.7905*		
Information Transfer in the past[2]	y_1	-.0137	.3284	.2455	.1300	.0207	.1304	.0052	36.0864*	
Information Transfer in the future	y_2	-.0338	.0176	.5012	.3970	.0235	-.1644	-.2128	-.2853	24.5933

*Because of the arithmetic precision of the computer algorithm used, a linear transformation of this variable's variances and covariances was performed to allow LISREL to provide model estimates. This transformation has no effect on the results and tests of significance.

[1]Variable transformed by multiplying the variance by .01.

[2]Variable transformed by multiplying the variance by 100.

[3]Variable transformed by multiplying the variance by 1000.

TABLE 22. Correlations and Standard Deviations (on the diagonal) among the Nine Indicators in the Model of Information Transfer in Organizational Dyads for Non Boundary Dyads. N = 581

		x_1	x_2	x_3	x_4	x_5	x_6	x_7	y_1	y_2
Formal Network Location[1]	x_1	23.3536*								
Informal network location[1]	x_2	-.2265	80.6553*							
Closeness	x_3	.0536	-.0658	27.1063						
Frequency of Communication	x_4	-.0462	-.0497	.4205	62.3426					
Symmetry[3]	x_5	.0688	-.0178	.0394	-.0393	33.8620*				
Information Value to Others[2]	x_6	.1123	-.1594	.0967	-.0016	-.0470	50.2368*			
Information Value to Self[2]	x_7	.2572	-.2036	-.0401	-.0573	.0681	.3625	50.0328*		
Information Transfer in the past[2]	y_1	-.0089	.2253	-.0569	.1357	-.1329	.0170	.0695	51.0084*	
Information Transfer in the future	y_2	.1284	.0257	.5483	.2894	.0052	.0628	.0373	-.0144	26.3114

*Because of the arithmetic precision of the computer algorithm used, a linear transformation of this variable's variances and covariances was performed to allow LISREL to provide model estimates. This transformation has no effect on the results and tests of significance.

[1]Variable transformed by multiplying the variance by .01.

[2]Variable transformed by multiplying the variance by 100.

[3]Variable transformed by multiplying the variance by 1000.

Table 23. Parameter Estimates and Standard Errors for Bridge Dyads.

Parameter	Parameter Estimate (ML)	Standard Error
λ_{11}	−3.195	(2.609)
λ_{21}	1.000**	
λ_{32}	1.000**	
λ_{42}	0.794*	(.244)
λ_{53}	−0.053	(0.142)
λ_{63}	1.000**	
λ_{73}	1.380*	(0.316)
γ_{12}	0.430*	(0.171)
γ_{13}	0.238	(0.121)
γ_{21}	−1.101	(0.900)
γ_{22}	0.353	(0.126)
γ_{23}	−0.213	(0.162)
ϕ_{11}	71.684	(88.451)
ϕ_{21}	79.766	(73.781)
ϕ_{22}	1063.171*	(297.252)
ϕ_{31}	−194.005	(168.506)
ϕ_{32}	−459.635	(188.909)
ϕ_{33}	1575.247	(567.554)
ψ_{11}	1164.268*	(189.934)
ψ_{21}	−247.293*	(90.812)
ψ_{22}	401.408*	(96.362)
$\theta\delta_1$	234.917	(514.737)
$\theta\delta_2$	1496.934*	(237.748)
$\theta\delta_3$	38.843	(243.245)
$\theta\delta_4$	2415.686*	(405.071)
$\theta\delta_5$	2244.643	(348.548)
$\theta\delta_6$	2261.996*	(462.489)
$\theta\delta_7$	620.152	(575.893)

* This parameter estimate is significantly different from zero since the t value is greater than 2.

** This parameter estimate was fixed for scaling purposes.

$n = 84$

$\chi^2 = 28.41$; 20 df; $p \leq 0.10$

squared multiple $R_{\eta 1} = 0.14$

squared multiple $R_{\eta 2} = 0.340$

$r^2_{\eta 1 \eta 2} = 0.494$

Table 24. Parameter Estimates with Standard Errors for Nonboundary Dyads.

Parameter	Parameter Estimate (ML)	Standard Error
λ_{11}	1.000**	
λ_{21}	−5.206	(1.103)
λ_{32}	1.000**	
λ_{42}	1.200	(0.164)
λ_{52}	0.046*	(0.066)
λ_{63}	1.000**	
λ_{73}	1.839	(0.444)
γ_{11}	−2.686	(0.859)
γ_{12}	0.062*	(0.122)
γ_{13}	0.769	(0.260)
γ_{21}	−0.282*	(0.250)
γ_{22}	0.678	(0.089)
γ_{23}	0.149*	(0.083)
ϕ_{11}	81.957	(25.608)
ϕ_{21}	28.475*	(17.189)
ϕ_{22}	592.226	(80.951)
ϕ_{31}	107.768	(33.451)
ϕ_{32}	−15.790*	(31.456)
ϕ_{33}	495.475	(146.978)
Ψ_{11}	2171.412	(217.753)
Ψ_{21}	−35.745*	(56.442)
Ψ_{22}	425.501	(41.314)
$\theta\delta_1$	463.435	(33.974)
$\theta\delta_2$	4284.384	(567.191)
$\theta\delta_3$	142.527	(68.332)
$\theta\delta_4$	3033.368	(210.404)
$\theta\delta_5$	1145.399	(70.376)
$\theta\delta_6$	2028.272	(169.162)
$\theta\delta_7$	827.719	(390.259)

* This parameter estimate is significantly different from zero since the t value is greater than 2.

** This parameter estimate was fixed for scaling purposes.

$n = 531$

$\chi^2 = 185.37$; 19 df; $p \leq 0.000$

squared multiple $R_{\eta 1} = 0.165$

squared multiple $R_{\eta 2} = 0.385$

$r^2_{\eta 1 \eta 2} = 0.488$

the assessment of differences between parameter estimates in bridging and nonbridging dyads. The procedure used created proxies for the unobserved variables $\xi_1, \xi_2, \xi_3, \eta_1, \eta_2$ for the nonbridge and boundary models.

The objective of this procedure was to obtain approximate parameter estimates of the relationship between the latent (unobserved) variables. The first step was to obtain an estimate for the unobserved variables. This was done by assuming the factor structure, i.e., the structure relating the unobserved variables to the observed variables, of the bridging and nonbridging models of information transfer in organizational dyads were the same. The estimates obtained from LISREL for the bridge and non boundary dyads models were used to create these unobserved variable estimates for the non bridge and boundary dyads. The factor score regression coefficients for the bridge model were used to obtain the estimate for the nonbridge latent variables and the factor score regression coefficients for the nonboundary model were used to obtain the estimates for the boundary latent variables.

Factor score regression coefficients represent estimated regressions of latent variables on all the observed variables. These coefficients can be used to obtain factor scores for the ξ and η variables. Jöreskog and Sörbom (1981) provide an example of how this can be done.

> These coefficents represent the estimated bivariate regression of x_1 and x_2 on all the observed variables and have been computed by the formula $A = \Phi\Lambda_X\Sigma^{-1}$ (see Lawley & Maxwell,1971, p.109). The matrix A may be saved on a file and used to compute estimated factor scores ξ_α for any person with the observed scores x_α, say, by the formula
>
> $$\xi_\alpha = A\xi_\alpha$$
>
> When the LISREL model involves ξ- and η- variables the factor scores regression will be computed by regressing all the the ξ an η variables on all the observed variables.(p. III.21)

Each of the observed variables for the nonbridge and boundary dyads was

standardized before the estimates for the latent (unobserved) variables was computed so that the parameter estimates would be comparable. Parameter estimates for the latent variable relationships were obtained through regression. A check for multicollinearity among the unobserved variables was done by examining the determinant of the correlation matrix. The determinant of the correlation matrix of the unobserved variables for non bridge dyads was approximately .552. The determinant of the correlation matrix of the unobserved variables for bridge dyads was approximately .830. The range of the determinant of this matrix is 0 to 1 with 0 indicating perfect multicollinearity and 1 complete independence of the unobserved variables. Under conditions of multicollinearity the regression coefficients are uninterpretable.

Table 25 presents the regression coefficient estimates obtained for the two structural equations using this procedure for the nonbridge dyads. Note that only the second equation predicting future information transfer is significant and that the only significant coefficient is the one for relational propensity/strength of tie. Table 26 presents the regression coefficient estimates obtained for the two structural equations for the boundary dyads. Note that again only the second equation predicting future information transfer is significant and that only the coefficient for information value is significant.

The last step in this process was to compare the parameter estimates for bridge dyads with nonbridge dyads and boundary dyads with nonboundary dyads to see if there is a significant difference between the factors that influence information transfer. The proxy estimates (regression coefficients and standard errors) were compared with the LISREL parameter estimates for the relationships between the latent variables (Γ matrix). Table 27 presents the comparison of the parameter estimates with standard errors for bridge and nonbridge dyads. The only parameter estimate that was significant for both bridge and nonbridge dyads was γ_{22} the relationship between relational

Table 25. Non Bridge Dyad Regression Coefficients and Standard Errors (SE) for the Theoretical Model

	Regression Coefficient $_{\eta 1}$ (SE)	Regression Coefficient$_{\eta 2}$ (SE)
Access to Information (ξ_1)	0.194 (0.510)	−1.737 (0.484)
Relational Propensity/ Strength of Tie (ξ_2)	0.080 (0.106)	0.680*(0.101)
Information Value (ξ_3)	0.331 (0.206)	−0.288 (0.196)
Multiple R	= 0.167	= 0.608
R^2	= 0.027	= 0.369
Adjusted R^2	= 0.002	= 0.353
SE	= 0.899	= 0.853
F	= 1.080	= 23.026*
df	= 3	= 3

n = 509

* Significant at $p \leq 0.01$
Determinant of the correlation matrix = 0.5522596

Table 26. Boundary Dyad Regression Coefficients and Standard Errors (SE) for the Theoretical Model

	Regression Coefficient$_{\eta 1}$ (SE)	Regression Coefficient$_{\eta 2}$ (SE)
Access to Information (ξ_1)	−2.4561 (1.509)	−0.697 (1.172)
Relational Propensity/ Strength of Tie (ξ_2)	−0.437 (0.498)	1.447 (0.387)
Information Value (ξ_3)	0.039 (1.854)	−2.808*(1.441)
Multiple R	= 0.465	= 0.726
R^2	= 0.216	= 0.527
Adjusted R^2	= 0.035	= 0.418
SE	= 0.982	= 0.763
F	= 1.195	= 4.820*
df	= 3	= 3

n = 132

* Significant at $p \leq 0.01$
Determinant of the correlation matrix = 0.8298321

Table 27. Comparison of Parameter Estimates and Standard Errors (SE) for Bridge and Non Bridge Dyads

Parameter	Non Bridge Parameter Estimate (SE)	Bridge* Parameter Estimate (SE)
γ_{11}	0.194 (0.510)	0.000
γ_{12}	0.080 (0.106)	0.430 (0.171)**
γ_{13}	0.331 (0.206)	0.238 (0.121)
γ_{21}	−1.737 (0.484)**	−1.101 (0.900)
γ_{22}***	0.680 (0.101)**	0.353 (0.126)**
γ_{23}	−0.288 (0.196)	−0.213 (0.162)
	n= 509	n = 84

* These estimates are proxies obtained through a regression procedure.
** This parameter estimate is significant.
*** The difference between these two parameter estimates is significant at $p \leq 0.01$; $-t = 8.3874$; df = 591.

Table 28. Comparison of Parameter Estimates and Standard Errors (SE) for Boundary and Non Boundary Dyads.

Parameter	Boundary* Parameter Estimate (SE)	Non Boundary Parameter Estimate (SE)
γ_{11}	−2.456 (1.509)	−2.686 (0.859)
γ_{12}	−0.437 (0.498)	0.062) (0.122)
γ_{13}	0.039 (1.854)	0.769 (0.260)**
γ_{21}	0.697 (1.172)	−0.282 (0.250)
γ_{22}	1.447 (0.387)	0.678 (0.089)**
γ_{23}	−2.808 (1.441)**	0.149 (0.083)
	n = 132	n = 531

* These estimates are proxies obtained through a regression procedure.
** This parameter estimate is significant.

propensity/strength of tie and future information transfer. An approximate difference of means test was performed.The formula used to make the comparison was:

$$t^{*} = \frac{(\text{bridge})\ \gamma_{22} - (\text{nonbridge})\ \gamma_{22}}{SE_{(\text{bridge})\ \gamma 22 - (\text{nonbridge})\ \gamma 22}} \qquad (18)$$

t^{*}, is an approximate difference of means test. Note that the standard error estimate in the denominator is the standard error of the difference between the two estimates. This is computed:

$$SE_{(\text{bridge})\ \gamma 22 - (\text{nonbridge})\ \gamma 22} = \sqrt{\frac{s_1^2}{N_1 - 1} + \frac{s_2^2}{N_2 - 1}} \qquad (19)$$

The degrees of freedom are computed as df = $N_1 + N_2 - 2$. As noted in Table 27, the difference between these two parameter estimates is significant, ~t = 8.3874 with df = 591 and $p \leq .01$. This implies that the effect of relational propensity/ strength of tie on future information transfer differs significantly depending on whether the dyad is a bridge or nonbridge dyad. The relationship between relational propensity/strength of tie and past information transfer was significant for bridge dyads and not significant for nonbridge dyads. The relationship between access and future information transfer was significant for nonbridge dyads and not for bridge dyads. Table 28 presents the comparison of the parameter estimates with standard errors for boundary and nonboundary dyads. There were no parameter estimates that were significant for both boundary and nonboundary dyads. For boundary and nonboundary dyads, the following differences were noted. The relationship between relational propensity/strength of tie and future information transfer was significant for nonboundary dyads and not significant for boundary dyads. The relationship between information value and future

information transfer was significant for boundary dyads and not significant for nonboundary dyads.

This analysis must be considered exploratory. However, it supports the hypothesized relationships about tie strength under bridging conditions and reinforces the viability of further research on the bridging phenomenon. A test of the influence of bridging conditions with a new data set is necessary to substantiate these findings.

5.5 Summary

This chapter has presented the test of the model of information transfer in organizational dyads. Model misspecification led to modifications to the original model and to the development of a series of hierarchically nested models. The best fitting model indicates that there is a negative relationship between access to information and past information transfer, a positive relationship between information value and past information transfer, a positive relationship between access to information and future information transfer, and a positive relationship between relational propensity/ strength of tie and future information transfer. A comparison of the model of information transfer under bridging and nonbridging conditions was done. There was a significant difference in the effect of relational propensity/strength of tie under bridge and nonbridge conditions which implies that information transfer is affected differently by the strength of the relationship when dyad members are in different groups or the same group.

Chapter 6

Conclusions and Discussion

Organizations process a large amount of information through interpersonal channels. An organization's effectiveness, adaptability, success and survival can depend on the transfer of information. If organizations are to become more effective and in many cases more responsive to their environments, an understanding of the way in which information is transferred is necessary. The goal of this research is to understand the factors that influence the person-to-person transfer of information within and between organizational structures. This is especially important for understanding how organizations become integrated and how they take in information from their environments. To this end, this research has used and expanded upon Granovetter's "Weak Tie" thesis, which states that weak ties function to infuse information into systems. This is their strength. The crucial issue, however, is not whether a tie is strong or weak but whether it moves information through the system.

Granovetter (1980) posited that weak ties that transfer information tend to be from different groups rather than the same group. These ties bridge groups when they transfer information. This bridging phenomenon, regardless of the strength of the tie, is considered important for understanding the factors that influence the transfer of information. This chapter will discuss how well the model of information transfer represented these person-to-person processes in an organization and the influence of the bridging phenomenon on the examined information transfer.

The proposed model of information transfer in organizational dyads states that information transfer is a function of three factors: a dyad's access to information, its

relational propensity/tie strength, and the value of the information as perceived by the members of the dyad. These three factors take into account the multiplexity of contexts that exist in an organization, the qualities of the relationships that exist between individuals in an organization, and the impact the orientation to the information content has on the transfer of information within the organization.

6.1 Testing a Model of Information Transfer in Organizational Dyads

The model of information transfer in organizational dyads as originally conceived specified that three variables—access to information, relational propensity/ tie strength and information value—determine the likelihood of information transfer. Access to information was measured by an individual's location in the informal and formal network. Relational propensity/tie strength was measured by closeness of the dyad, its frequency of interaction, and the symmetry of the link. Information value was measured by information value for self and information value for others.

Due to specification problems with the way likelihood of information transfer was conceived and measured, the original model could not be tested without modification. Subsequent modifications to the model were made to increase the explanatory power of the model. This section will discuss these modified models. All the models tested were a significant improvement in fit over the null model. All the tested models of information transfer provide a better explanation of how information is transferred than if no relationship were posited among the variables in the model. The best fitting model of information transfer is Model 6, in which the greatest modification could only yield a 10 percent increase in explanatory power.

The findings about the relationships among the variables as specified in Model 6 are that access to information and relational propensity/tie strength determine information transfer in the future. Information value was not a significant predictor of future

information transfer and might in fact have no impact on future information transfer. Relational propensity/tie strength was almost twice as strong a predictor of information transfer as access to information. The fact that the strength of the tie had more impact on future transfer of information than on past transfer of information may be due to serendipitous, actual transfer of information (especially with weak ties), in contrast to the anticipated transfer of information to individuals with whom one has or desires regular contact. Information is often transferred as the result of a chance meeting of two organizational members. When asked to anticipate who one would transfer information to, these chance encounters may not be anticipated with individuals one has limited contact with. In Model 6, the measurement model was modified with closeness as an indication of access to information. At first this seemed to be counter intuitive. However, a possible explanation for the appropriateness of including this indicator was discussed by Burt (1976). He asserted that a dyad composed of two individuals in the same clique is in fact closer together than dyads in different cliques even though they may have the same intensity of linkage. Closeness therefore might indicate the level of structural cohesion. This would imply that distance and location are functions of the dyadic context as well as the network context.

The appropriateness of a multiple indicator assessment of strength of tie was apparent. Both interaction frequency and closeness were viable measures of relational propensity/tie strength. Symmetry was not significant as an indicator of relational propensity/tie strength. A measure of mutuality or reciprocity may be more appropriate as an indicator of the dyadic relationship. Reciprocity is the degree to which the assessment of a link quality is mutual. It also assesses the degree to which the relationship is one-way or two-way more comprehensively than does symmetry.

Another modification to the original model was to split the two indicators of

likelihood of information transfer into past and future information transfer. These indicators appeared to be measuring separate factors because of their low negative correlation. This is contrary to the expectation that past information transfer would be related to future information transfer. One possible explanation is incompatibility of the scales of measurement. Past information transfer was measured as the number of times information was transferred and future information transfer was measured as a probability estimate.

6.2. Findings on the Bridging Phenomenon

The results of the analysis of the models of information transfer under bridging and non bridging conditions will be discussed in this section. The only relationship that was influenced by bridging conditions was the influence of relational propensity/tie strength on information transfer. This finding indicates that different processes are operating to cause information to be transferred depending on whether the members of the dyad are in the same informal organizational group or different informal organizational groups. This finding appears to support Friedkin (1979) and Weimann's (1983a) findings that bridging ties tend to be weaker than non bridging ties. This was the case for bridge dyads but not for boundary dyads. Relational propensity/tie strength however was not a significant predictor of future information transfer in dyads that spanned different formal organizational units. It appears that location of two organizational members in the same organizational unit or different organizational units (as specified on the organizational chart) does not differentially affect the influence the relationship between the two individuals has on whether they will transfer information to each other. This finding suggests that informal groups in an organization may be more distinct than the formal groupings that are depicted by the organizational chart. For example, in studies of organizational culture looking at informal groups may represent distinctions

between organizational units more precisely.

However, within the same organizational unit (non boundary), it appears that the stronger the relationship between two organizational unit members the greater the probability that information will be transfered. In both the bridging and non bridging conditions, the structural equations predicting information transfer in the past were not significant. The direction of the relationship among the variables in the model of information transfer were the same for bridge and non bridge dyads.

Access to information was a significant predictor of information transfer in the future when two organizational members were from the same informal group in the organization but not when they were from different informal groups. One explanation for this lack of significance could be how access was measured. The index created to assess access included a measure of density. Density may not be the best estimate of network dispersion (see Bauer, 1982). Future tests of this model might include a more appropriate measure of network dispersion.

One of the implications of these findings for organizations is that only manipulating the structure of relationships among members of the organization may not guarantee that information will be transferred in the organization. Often the networks in an organization are manipulated, e.g., through task forces or multidisciplinary teams, in order to effect transfer of information throughout the larger organization. The findings suggest that manipulating structure alone may not guarantee the transfer of information to the rest of the organization. Information value was a significant predictor of information transfer in the future when organizational members were in different formal organizational groups, i.e., departments or service areas.

The bridging phenomenon needs to be explored further and recommendations for expanding upon these findings are presented later in this chapter. The bridging

phenomenon does not operate in the same way in the formal and informal organization. The degree to which transfer is influenced by different factors varies by dyad location and type of bridging dyad. The fact that the information transfer models for non bridge and boundary dyads were not testable might indicate that factors not specified in the models are important to information transfer for one type of dyad and not the other type. What these factors are needs to be explored.

6.3. Contributions and Concerns

Granovetter's "Weak tie" thesis has been used in the literature to explain the transfer phenomenon in social systems (see Rogers & Kincaid, 1981). Tests of this thesis have been limited. A contribution of this research is that it lends supports to the validity of this concept and expands the knowledge about the effects of bridging on information transfer. A strength of the approach used in this study is that weak ties were not a priori assumed to transfer information. Rather, all ties were considered to have the potential for transfer. In effect, this research incorporated the notion that both strong and weak ties are determinants of information transfer. Tie strength was conceptualized and operationalized in a manner consistent with Granovetter's explication of the concept. Typically only one indicator of tie strength is used, while this study used multiple indicators of tie strength.

The model of information transfer in organizational dyads that was developed incorporated multiple system levels in the explanation of the transfer of information. The multiplexity of networks in organizations (formal and informal) was also incorporated in the model. The dyad was the unit of analysis in this research rather than the individual or group.

The concept of what a "bridge" is was clearly delineated in two organizational contexts, the formal and informal organization. The findings about the bridging

phenomenon lent empirical support to Granovetter's (1980) assumptions that the "strength of weak ties" occurs when the ties are bridges. However, this finding held only in the informal organization not the formal organization. Quality of the relationship had a different impact on whether information is transferred when informal groups were spanned than when formal organizational units were spanned. It was apparent from the results that under different bridging conditions the three factors influence information transfer differently. There may be other factors operating which also affect transfer of information.

There were a number of methods and procedures that were created during the study that are contributions to organizational communication research. First, a computer program for generating network data in which the links between nodes in the network are portrayed on a number of variables simultaneously was created. This network program did not previously exist to generate this type of data. Secondly, the procedure that was used to compare the models under bridging and non bridging conditions may be useful. This procedure generated estimates of the relationships between the unobserved variables in the model. It may be useful to use this procedure when there is a need to compare a model using different data sets. The procedure is especially useful under conditions where misspecification does not allow estimation of the full model with one of the data sets, as was the case in this research. Another strength of the research was that in spite of the field setting and large sample, a high response rate was obtained because of the data collection procedures used before, during and after data collection.

There are also weaknesses in this research that need to be addressed. The findings discussed and described should be viewed tentatively since the original model as specified, was untestable. New data sets should be used to confirm the findings. The issue of nonindependence of the sample was presented in Chapter 3. This is an important

concern that may not be readily addressed in future network research that focuses on linked individuals in organizations. By trying to capture and assess organizations as interlocking systems of individuals, violations of independence of the sample may be a given. For example, each person's relationship with another person may put constraints on the time or intensity of the relationship the individual can have with others in the organization. There are limits on the time an individual has available to interact with others.

6.4 Directions for Future Research

This section will focus on the areas of research that would complement and expand on the research presented here. This research supports the idea that tie strength influences information transfer processes. It is apparent that transfer processes are greatly influenced by the dynamics of the relationship. Future research should use tests of the "weak tie" thesis with a broader approach to measuring the "strength of a tie." This implies that more than one indicator of the relationship between organizational members is needed to assess the strength of the tie.

The belief that bridging ties tend to be weak was supported in the research; however, this still does not explain what factors cause the ties to be weak. The evolution of bridging weak ties, as an area of study, might be useful. Some of the questions that might be addressed are whether "weak" bridging ties, i.e., those that bridge or span boundaries, are actually strong ties that no longer exist. The question to be asked might be "Are bridging ties that are weak actually strong ties that have diminished in intensity but continue to exist at a low level of intensity?" A second approach to this issue might test the possibility that lack of transitivity under certain conditions is a determinant of weak bridging links. It may be that if there are very strong ties between A and B and between B and C, when the C to A link occurs there is a greater probability

that it will bridge. Or if a node is one step removed from strong transitive links, information transfer may create bridging weak ties. Knowing if weak ties that tend to transfer information between informal groups in an organization were actually at one time strong ties might help to explain how organizing, coordinating and integration in organizations occurs over a period of time.

Another area for future research would focus on how the quality and types of information affect transfer between organizational member. As was noted earlier, it is not enough to say that a link exists; it is what flows through the link that is important. This study did not focus on the qualities or types of information transferred. Weimann (1983a) found differences in whether bridges transferred information depending on the type of message sent. As organizations become more decentralized and operate in more turbulent environments, there is a need to insure that bridging occurs so that the quality of the information transferred meets certain criteria for accuracy and utility. Burt (1980) notes that organizations that have the greatest need to co-opt their environments should have the greatest range. Research that is able to delineate the factors that influence different qualities of the information being transferred through bridging ties may help decision makers in these organizations create stategies for rapidly moving information.

This research does not address how an individual's load may influence when and what information is transferred. The degree to which load influences the transfer process may need to be assessed in future research on information transfer under bridging conditions. The load of any node as a function of access to information was described in this study as influencing the transfer process. However, the impact of load on the transfer process may be a function of the individual's ability to cope, the information itself, and the quantity of information that moves to a specific location in the network.

Load of individuals in the network may influence whether information is transferred regardless of the strength of the link, the value or the information or location. Future exploration of this variable may provide useful information about the transfer process.

This research did not deal with individual personality factor or qualities of the individual. This may be appropriate if future studies assess directionality of the linkage. Granovetter (1980) noted that structure and qualities of the individual may influence a tie acting as a bridge. A question that needs to be answered is whether there are individuals who are more likely to create bridges. There may be individuals who function more effectively and seek out opportunities to span information spaces or are perceived by others as appropriate to this role. Tushman and Scanlon (1981) found that one of the antecedents of boundary spanning roles in an organization was the perception of these individuals by their colleagues as competent and having the background and skills to communicate with different external areas.

As organizations move towards more autonomous, decentralized structures, communication across these structures will be a continuing concern. The ability to foster information transfer between these structures may be crucial to the achievement of quality in service or product and ultimately the organization's survival. Understanding the factors that foster the bridging of structures may provide insight into methods for creating these crucial links so that information is distributed in an optimal fashion.

6.5 Summary

This chapter has discussed the results of a study of information transfer in organizational dyads. The implications of this research for organizations were presented. Contributions of the research and weaknesses that need to be addressed in future research were discussed. Areas of future research that would expand and reinforce this study were presented.

Appendix A

Sampling Procedure Used with the Michigan Department of Education

Sampling Procedure Used with the Michigan Department of Education

A maximum sample of 500 individuals from the Department of Education was determined based on financial constraints. The following criteria were used to obtain the sample. These criteria were developed based on methodological and practical concerns.

1. All supervisory level and above employees were included in the sample.

2. All employees with offices in the Michigan National Tower were included in the sample.

3. Service Areas were sampled as intact units.

4. Service areas were randomly selected.

5. Disability Determination Services was not included in the baseline group because of its special status.

Using these criteria, the following areas were included in the survey:

Office of the Superintendent
Associate Superintendents
Assistant Superintendents
Office of the State Board of Education
Office of Public Affairs
Office of School and Community Affairs
Office of Legislation and School Law
Office of Personnel Management
Office of Planning
Office of Professional Development
Office of Program Coordination
Research, Evaluation and Assessment Services (excluding Assessment Program)
All other members of the Executive and Administrative Councils

There were 156 people in these nonrandomly selected groups. The following is the sample of service areas selected for inclusion in the study:

Student Financial Assistance Services
Research, Evaluation and Assessment Services (Assessment Program)
School Support Services
Special Education Services
Adult and Extended Learning Services
Department Services
Field Services

The sampling procedure used entailed developing a list of all sevice areas and offices as

Appendix B

Interview Questions for the Michigan Department of Education

they appeared in the organizational chart. A random selection was made using a table of random numbers. As a service areas was selected the number of people in the area was subtracted from 500 (the maximum number of people to be included in the study). This process was used until approximately 500 individuals were obtained. The final sample was 492.

INTERVIEW QUESTIONS FOR MICHIGAN DEPARTMENT OF EDUCATION STUDY

JOB DESCRIPTION:

1. What is your official job title?
2. Describe your job. What is it that you do?
3. How autonomous is your job? How many discretions do you have in determining what you do?
   To what degree do you have control over the initiation and follow through on tasks?

3b. How important is what you do? How much do you affect the work of others in the department?

PHYSICAL SURROUNDING:

4. How would you describe the physical surroundings you work in?
   e.g.: Amount of space, noise, privacy, temperature, or ease of interaction.
5. What would an ideal office be like for you?
   What are the things that are good and bad about your current office facilities?
   Tell me about your own work area and the other areas in your administrative unit?
   Why are these things good or bad?

INFORMATION:

6. What types of information do you need to do your job?
7. How do you get this information?
8. What are the factors that you think influence your getting the information you need to do your job?
9. To what extent do you get the information needed to do your job?
10. How do you usually hear about things happening in the Department of Education?
11. Why do you think people tell you about things happening in the department?
12. What do you do if you want to get information about new events or things happening in the department?
13. What have you heard about the move to the new office building?
14. How did you find these things out?
15. What do you think are factors that cause people to give others information?

CLIMATE:

16. Describe how you feel about your job? Working in the department?
    .....how important is your job to you?
    .....do you enjoy work?
    .....do you like the people you work with?
    .....is there somethng you would rather be doing? Somewhere else you would rather work?
17. Describe the type of relationship you have with the person you work for?
    .....do you share information?
    .....are you open with each other?
    .....do you like each other?
    .....does this person keep you informed?
    .....how does this person provide you with feedback?
18. Describe the type of relationship you have with the people that work for you?
    .....do you share information?
    .....are you open with each other?
    .....do you like each other?
    .....do you keep these people informed?
    .....how do you give them feedback (frequency)?

18b. To what extent does your working in the department provide opportunities for developing close relationships?

19. What are the factors that influence your relationship with your superiors and subordinates?
20. Are you satisfied with your job? What do you think influences this assessment? What can be done to increase your satisfaction?

REDUCTION IN PERSONNEL:

The department is currently transferring and laying off people as you are probably aware of.

21. How is your area affected by this? How are you affected by this?
22. What do you see people doing to cope with this situation?
23. Describe an incident that illustrates how people are handling this situation.
24. What affect do you think this is having on morale?
25. Do you discuss this situation with others? What types of things are discussed?
26. What affect do you think the reductions and transfers will have on staff's reaction to the move to the new office building?
27. Are there any other things that you believe are affecting the Department of Personnel?
    What are they and how do you think they are affecting them?

MICHIGAN STATE UNIVERSITY

COLLEGE OF COMMUNICATION ARTS AND SCIENCES
DEPARTMENT OF COMMUNICATION

EAST LANSING · MICHIGAN · 48824

Dear MDE Staff Person:

The move to the Ottawa Street Office Building can have an impact on many aspects of how work occurs in the MDE. In some ways the move to the new building may make things better for staff. In other ways, the move may have no effect. And in some ways the move may make working more difficult.

We have designed this questionnaire to obtain information about your attitudes, communication, current working conditions and knowledge about the new building. These areas were chosen since research on organizations in situations similar to the MDE's has found these areas important. The results of the questionnaire will give us an overview of the organization. The overview might be thought of as "taking the temperature" of the organization. Once the "temperature" has been taken, we can prescribe ways in which the transition to the new building can be made less disruptive.

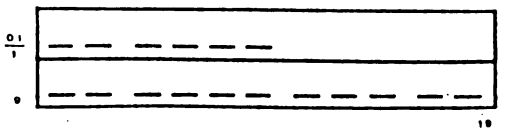
There are two components to obtaining this overview. First, you are asked to fill out the attached questionnaire. Directions for filling it out are given before each section. Second, you are asked to complete a communication directory which lists the names of approximately 500 people in the Department. In the directory, you are asked to indicate the people that you communicate with in the Department. Directions are provided in the beginning of the directory.

All the information you provide us will be strictly confidential. The information provided to the Department will not identify any individual responses. The results of the questionnaire and the communication directory will be kept at Michigan State University. To insure confidentiality it is important that you do not discuss the questionnaire, directory or any of your responses with anyone in the Department.

A summary of the recommendations to the Department will be provided to all Department employees in a future edition of "F.Y.I." If you have any questions about the questionnaire, results, or the feedback process in general, you can contact Dr. Richard V. Farace at 355-3478 or Dr. Eugene Paslov at 373-3357.

Thank you for your time and effort!

Richard V. Farace
Professor, Department of Communication



SECTION I – WORK ENVIRONMENT

The first part of the questionnaire seeks information about your work environment. WORK ENVIRONMENT includes the physical, social and information characteristics of your work.

PHYSICAL CHARACTERISTICS refer to heating, lighting, office layout, etc. in your work environment.
SOCIAL CHARACTERISTICS refer to privacy, ease of communication, relationships with others, etc. in your work environment.
INFORMATION CHARACTERISTICS refer to whom you give information, receive information from, the kinds of information you exchange, and its importance in your work.

The questions in Parts A, B, and C address the physical and social characteristics of your work environment. The questions in D and E tap the information characteristics of your work environment.

A. THINK ABOUT YOUR CURRENT WORKING CONDITIONS – YOUR OFFICE ENVIRONMENT AND WORK SPACE immediately surrounding you.

Indicate the degree to which you AGREE or DISAGREE with the following statements by circling the appropriate number.

		STRONGLY DISAGREE	DISAGREE	slightly disagree	neither	slightly agree	AGREE	STRONGLY AGREE
1. MY WORK AREA IS:								
a. adequately lighted	31	1	2	3	4	5	6	7
b. large enough for my needs	32	1	2	3	4	5	6	7
c. adequately equipped for my work	33	1	2	3	4	5	6	7
d. at a comfortable temperature throughout the year	34	1	2	3	4	5	6	7
e. located close to people I need to talk with in my job	35	1	2	3	4	5	6	7
f. located near personal facilities (for example, bathrooms, eating areas, etc.)	36	1	2	3	4	5	6	7
2. MY WORK AREA PROVIDES:								
a. the quiet I need to do my work	37	1	2	3	4	5	6	7
b. the visual privacy I need to do my work	38	1	2	3	4	5	6	7
c. enough storage for my work needs	39	1	2	3	4	5	6	7
3. IN MY WORK AREA:								
a. I feel free to discuss private matters without being overheard	40	1	2	3	4	5	6	7
b. I have no worries about my property being stolen	41	1	2	3	4	5	6	7
c. the noise level makes me irritable and uneasy	42	1	2	3	4	5	6	7
d. it is hard to concentrate on what I am doing	43	1	2	3	4	5	6	7
e. I am aware of others passing nearby	44	1	2	3	4	5	6	7
f. I am aware of others working nearby	45	1	2	3	4	5	6	7

This set of questions addresses social characteristics of your work environment. These questions focus on the group of people that you work with. Two kinds of groups are found in the MDE: Service areas, e.g., Department Services, REAS; and Offices, e.g., Office of the Superintendent, Office of Professional Development.

B. THINK ABOUT THE SERVICE AREA-OFFICE THAT YOU WORK IN AND THE PEOPLE THAT YOU WORK WITH.

Indicate the degree to which you AGREE or DISAGREE with the following statements by circling the appropriate number.

		STRONGLY DISAGREE	DISAGREE	slightly disagree	neither	slightly agree	AGREE	STRONGLY AGREE
4. IN MY SERVICE AREA/OFFICE:								
a. it is easy to talk openly to all people	46	1	2	3	4	5	6	7
b. it is easy to ask advice from any person	47	1	2	3	4	5	6	7
5. I FEEL THAT:								
a. I am really a part of my service area/office	48	1	2	3	4	5	6	7
b. there are feelings among people that tend to pull the service area/office apart	49	1	2	3	4	5	6	7
c. I look forward to being with others in my service area/office each day	50	1	2	3	4	5	6	7
d. there is too much bickering in my service area/office	51	1	2	3	4	5	6	7

C. THINK ABOUT YOUR SERVICE AREA/OFFICE AND ESTIMATE THE FOLLOWING:
(Indicate the number that is appropriate)

6. HOW MANY PEOPLE in your service area/office: (e.g., 005, 015)

a. regularly ask you for information	52	___	___	___
b. do you regularly ask for information	53	___	___	___

7. IN AN AVERAGE WEEK, HOW MANY REQUESTS FOR INFORMATION:

a. do you receive from people in your service area/office?	54	___	___	___
b. do you make of other people in your service area/office?	55	___	___	___

The next set of questions measures the information characteristics of your work environment. People's behavior may be influenced by information and one's perception of it.

D. THINK ABOUT THE INFORMATION THAT YOU HAVE ABOUT THE OTTAWA STREET BUILDING AND YOUR REACTIONS TO THAT INFORMATION.

Indicate the degree to which you AGREE or DISAGREE with the following statements by circling the appropriate number.

		STRONGLY DISAGREE	DISAGREE	slightly disagree	neither	slightly agree	AGREE	STRONGLY AGREE
8. THE INFORMATION I HAVE RECEIVED ABOUT THE MOVE TO THE OTTAWA STREET BUILDING:								
a. has been timely	64	1	2	3	4	5	6	7
b. has been useful	65	1	2	3	4	5	6	7
c. has adequately answered my questions	66	1	2	3	4	5	6	7
d. indicates that it will be a positive experience	67	1	2	3	4	5	6	7
e. makes me think that Department employees will have problems working there	68	1	2	3	4	5	6	7
f. indicates that my work space there will be adequate	69	1	2	3	4	5	6	7
9. OVERALL, MY EXPECTATIONS ABOUT THE MOVE TO THE OTTAWA STREET BUILDING ARE THAT:								
a. the move is of no concern to me	70	1	2	3	4	5	6	7
b. I look forward to the move	71	1	2	3	4	5	6	7
c. I feel anxious about the move	72	1	2	3	4	5	6	7
10. IT IS IMPORTANT FOR ME:								
a. to be the first one to give someone new information	73	1	2	3	4	5	6	7
b. to have lots of information about the Ottawa Street Building	74	1	2	3	4	5	6	7
c. to get more information about the Ottawa Street Building	75	1	2	3	4	5	6	7
11. IT IS IMPORTANT TO OTHER MDE STAFF:								
a. to be the first one to give new information	76	1	2	3	4	5	6	7
b. to have lots of information about the Ottawa Street Building	77	1	2	3	4	5	6	7
c. to get more information about the Ottawa Street Building	78	1	2	3	4	5	6	7

E. We are interested in how information about the Ottawa Street Building was and is distributed among people in the Department. The answers to these questions can be used to ensure that staff receive more and better information. There are two components to this part. We ask you to fill out two charts that indicate:

1. from whom you received information about the Ottawa Street Building
2. to whom you would provide new information about the Ottawa Street Building

BY INFORMATION we mean any new bits of knowledge about the new building, e.g., what it will be like, where you will be located, how people are reacting to the move. We are interested in communication whether written or oral except for official MDE memorandum, newsletters, reports.

12. THINK ABOUT THE PEOPLE IN THE DEPARTMENT THAT YOU RECEIVED INFORMATION FROM ABOUT THE OTTAWA STREET BUILDING IN THE LAST THREE MONTHS. TO FILL IN THE FOLLOWING TABLE:

Column 1 – List the NAMES OF PEOPLE in the Department who gave you information relating to the Ottawa Street Building

Column 2 – Estimate HOW MANY TIMES in the last 3 months each of these people gave you information, e.g., 004 times, 087 times.

Column 3 – Estimate HOW CLOSELY YOU SEE YOURSELF ASSOCIATED WITH each person. Indicate a number from 000–100.

We vary on how closely we see ourselves associated with other people. There are some people that we identify with and think of our relationship as close. There are others that in spite of the fact that we frequently have contact with them we do not view the relationship as close. Work as well as nonwork-related factors may influence how close we view our association with others.

For example: If you view the association with this person as the maximum closeness possible..... use 100 | 1 | 0 | 0 |
If you view the closeness of association as two thirds as close as it could be..... use 066 | 0 | 6 | 6 |
If you view the closeness of association as minimal or nonexistant..... use 000 | 0 | 0 | 0 |

For Coding Purposes Leave Blank	LAST NAME, FIRST INITIAL	NUMBER OF TIMES THIS PERSON GAVE YOU INFORMATION	HOW CLOSELY YOU ASSOCIATE YOURSELF WITH THIS PERSON (Indicate 000–100)
	(1)	(2)	(3)
02 1 9 — — —		| |	| |
10 — — —		| |	| |
20 — — —		| |	| |
30 — — —		| |	| |
40 — — —		| |	| |
50 — — —		| |	| |
03 1 9 — — —		| |	| |
10 — — —		| |	| |
20 — — —		| |	| |
30 — — —		| |	| |
40 — — —		| |	| |
50 — — —		| |	| |

(See Survey Administrator if you need more room)

THE FOLLOWING INFORMATION CONCERNS THE OTTAWA STREET OFFICE BUILDING. PLEASE READ IT BEFORE PROCEEDING TO THE NEXT CHART.

The Ottawa Street Office Building is located west of the State Capitol and is bordered by Ottawa, Allegan, and Pine Streets.

The MDE will occupy approximately 50% of the 360,000 square feet of rentable space in the two-tower building. This is most of the South Tower. There will be about 1,100 MDE employees moving into the building. The State Library will be the only service area not housed in the new office building.

The actual move to the building will begin December, 1982 and be completed by the end of February, 1983.

There will be a cafeteria and conference center available for use by the MDE in the upper parking level. The cafeteria will seat between 350–400 people and is similar to the cafeteria in the Mason Building. The 7200 square foot conference center consists of two large lecture rooms and two smaller conference rooms.

Office furniture in the Ottawa Street Building will be provided and is part of the Westinghouse openscape design. You will however bring your current desk chair with you. Service areas that have refrigerators and/or microwave ovens will also be able to bring them to the new building.

Within the next several weeks, your service area will be contacted to plan the physical layout of individual office spaces for specific programs and subunits on each of the following floors:

4th Floor . . . . . Superintendent's Office, State Board of Education, Bureau of Finance, Legislation & Personnel, Bureau of Rehabilitation, and Adult Extended Learning Services

3rd Floor . . . . . .Disability Determination Services

2nd Floor . . . . . Bureau of Elementary and Secondary Education and Bureau of Post-secondary Education with the exception of Student Financial Services

1st Floor . . . . . .Bureau of Postsecondary Education--Student Financial Services, Department of Natural Resources offices

Upper Parking Level . . . Data Processing Center, Cafeteria, and Conference Center
(Ground Floor)

(This is the current update of Bureau locations as of March 29, 1982.)

Think about the information on the preceding page. You may have heard some of the information already or not heard any of it at all.

13. IMAGINE THAT TWO WEEKS AGO YOU HEARD THE INFORMATION ON THE PRECEEDING PAGE. There are some people you would have gone out of your way to tell, others you might have told because you generally talk with them, and still other people whom you would have told because of a chance meeting.
CONSIDER ALL OF THESE POSSIBILITIES AND FILL OUT THE CHART BY THINKING ABOUT ALL THE PEOPLE YOU MIGHT HAVE TOLD THE INFORMATION.
Column 1 – List ALL the PEOPLE IN THE DEPARTMENT that you would have told any of the information.
Column 2 – Estimate what the LIKELIHOOD (probability) is that you would have told each of the people listed. Remember that some people you would have definitely told and others there was a slight chance.
(Use 000–100 to indicate the likelihood of telling the person)
For example: If you would definitely tell the person..... use 100
If you were as likely to tell them as not tell them (equal chance)..... use 050
If there was a 22% chance of telling them..... use 022
Column 3 – Estimate HOW CLOSELY YOU SEE YOURSELF ASSOCIATED WITH this person (Use 000–100. Remember 100 indicates the maximum closeness – see previous chart for explanation.)

For Coding Purposes Leave Blank	LAST NAME, FIRST INITIAL	LIKELIHOOD YOU WOULD TELL THIS PERSON (probability) (Use 000–100)	HOW CLOSELY YOU ASSOCIATE YOURSELF WITH THIS PERSON (Use 000–100)
	(1)	(2)	(3)
06 1 0 — — —			
10 — — —			
20 — — —			
30 — — —			
40 — — —			
50 — — —			
07 1 0 — — —			
10 — — —			
20 — — —			
30 — — —			
40 — — —			
50 — — —			

(See Survey Administrator if you need more room)

SECTION II. JOB ATTITUDES, JOB BEHAVIOR AND JOB DESCRIPTION

As was mentioned earlier, the move to the Ottawa Street Building may affect the way in which work is accomplished in the Department. Attitudes and behaviors may change as a result of the move. These questions have been validated and tested in numerous organizations to understand work behaviors. The following groups of questions are concerned with a general overview of how you view working in the Department and doing your job.

F. THE NEXT SET OF QUESTIONS IS ABOUT YOUR JOB. WHEN ANSWERING KEEP IN MIND THE KIND OF WORK YOU DO AND HOW YOU GO ABOUT DOING YOUR JOB.

Indicate how much you AGREE or DISAGREE with each statement as a DESCRIPTION OF YOUR JOB by circling the appropriate number.

		1 STRONGLY DISAGREE	2 DISAGREE	3 slightly disagree	4 neither	5 slightly agree	6 AGREE	7 STRONGLY AGREE
14. I often have to deal with new problems on my job.	9	1	2	3	4	5	6	7
15. A lot of people can be affected by how well I do my work.	10	1	2	3	4	5	6	7
16. I can see the results of my own work.	11	1	2	3	4	5	6	7
17. Just doing the work required by my job gives me many chances to figure out how well I am doing.	12	1	2	3	4	5	6	7
18. On my job, I produce a whole product or provide a complete service.	13	1	2	3	4	5	6	7
19. I have the freedom to decide what I do on my job.	14	1	2	3	4	5	6	7
20. My job requires that I do the same things over and over.	15	1	2	3	4	5	6	7
21. It is basically my own responsibility to decide how my job gets done.	16	1	2	3	4	5	6	7
22. I get to do a number of different things on my job.	17	1	2	3	4	5	6	7
23. On my job, I often have to handle surprising or unpredictable situations.	18	1	2	3	4	5	6	7
24. I often have to meet or check with other people in the Department in order to do my job.	19	1	2	3	4	5	6	7
25. I often have to cooperate directly with other people in the Department in order to do my job.	20	1	2	3	4	5	6	7

Indicate the degree each of the following is typical of YOUR JOB by circling the appropriate number.

		1 none at all/ very little	2	3	4 A Moderate Amount	5	6	7 VERY MUCH/ A GREAT AMOUNT
26. How much freedom do you have on your job? That is, how much do you decide on your own what you do on your job?	21	1	2	3	4	5	6	7
27. How much variety is there on your job? That is, to what degree do you do different things or use different procedures in the course of your job?	22	1	2	3	4	5	6	7
28. As you do your job, can you tell how well you are performing?	23	1	2	3	4	5	6	7
29. How much does your job involve producing a complete product or providing a service yourself? That is, to what degree do you work alone on the service or product from start to finish?	24	1	2	3	4	5	6	7
30. In general, how important is your job? That is, are the results of your work likely to significantly affect the lives and well being of others?	25	1	2	3	4	5	6	7
31. How much does the work you do on your job make a visible impact on the services or products of your area?	26	1	2	3	4	5	6	7

G. THE NEXT SET OF ITEMS ALLOWS YOU TO MAKE SOME OVERALL APPRAISALS OR ASSESSMENTS OF YOUR JOB, IN TERMS OF JOB SATISFACTION AND INVOLVEMENT. LIKE MANY OF THE OTHER QUESTIONS IN THIS QUESTIONNAIRE, THEY ARE TAKEN FROM SCALES THAT HAVE BEEN EXTENSIVELY VALIDATED AND TESTED IN OTHER ORGANIZATIONS.

Indicate the degree to which you AGREE or DISAGREE with the following statements by circling the appropriate number.		STRONGLY DISAGREE	DISAGREE	slightly disagree	neither	slightly agree	AGREE	STRONGLY AGREE
32. The most important things which happen to me involve my job.	27	1	2	3	4	5	6	7
33. What happens to this organization is really important to me.	28	1	2	3	4	5	6	7
34. Employees here feel you can trust top management.	29	1	2	3	4	5	6	7
36. All in all, I am satisfied with my job.	30	1	2	3	4	5	6	7
36. I live, eat and breathe my job.	31	1	2	3	4	5	6	7
37. When top management here says something, you can really believe that it is true.	32	1	2	3	4	5	6	7
38. In general, I don't like my job.	33	1	2	3	4	5	6	7
39. I don't care what happens to the MDE as long as I get my paycheck.	34	1	2	3	4	5	6	7
40. In general, I like working here.	35	1	2	3	4	5	6	7
41. I am very much personally involved in my work.	36	1	2	3	4	5	6	7
42. People in this organization will do things behind your back.	37	1	2	3	4	5	6	7

H. This set of questions asks you about you and your time with MDE.

43. How many YEARS have you worked in your present job? 38 ___ ___
(Use 00 if less than one year; e.g., 09 would indicate 9 years)

44. How many YEARS have you worked in the MDE? 40 ___ ___
(Use 00 if less than one year; e.g. 05 indicates 5 years)

45. Are you: (indicate 1 or 2) 42 ___
1 – Female
2 – Male

COMMUNICATION DIRECTORY

The purpose of this booklet is to obtain information about the communication among Department of Education employees. The booklet contains a list of approximately 500 names of Department employees. The list is a sample of Department employees and does not contain all the names of people in the Department.

We are interested in your communication with people in your own service area or office and in other service areas or offices.

The names are in the following order:

1. The Office of the Superintendent is listed first.

2. The Directory is then alphabetized by:

   A. Bureau
   B. Service Areas/Offices
   C. People's names

INSTRUCTIONS

In this booklet you are asked to report your communication with other Department of Education employees. There are approximately 500 names of other employees listed in this booklet. You are asked to review the names and report your communication with them. It is unlikely that you will know or have communicated with all the people listed. Disregard all names of people you do not know or have not communicated with in the last six months.

Respond for ALL the people listed with whom you have communicated in the last six months. Some of the people will be those you have communicated with frequently and some of them you will have communicated with only a few times. By COMMUNICATION, we mean any communication whether written or oral except official department communications such as memorandum, newsletters, reports.

There are two types of communication you are asked to report:

WORK-RELATED and NONWORK-RELATED

WORK-RELATED COMMUNICATION is communication that is necessary for the accomplishment of your job and the business of the organization. For example, communication related to task assignments, management information, or discussion at meetings.

NONWORK-RELATED COMMUNICATION is communication that is unrelated to work and the accomplishment of one's job. For example, social information, personal matters, and rumors.

Note that the list is alphabetized by Bureau, service area/office and last name. This is to aid you in finding the names of people within your service area/office as well as in other service areas or offices with whom you have communicated.

Use the following steps in completing the directory:

1. Find YOUR NAME and CIRCLE IT.

2. Read through the list. When you come to the name of someone you have communicated with in the last six months, first indicate how often you communicated with him/her on WORK-RELATED MATTERS and then how often you communicated with him/her on NONWORK-RELATED MATTERS. Circle the appropriate number corresponding to the following scale:

1 – once a year	5 – once a week
2 – a few times a year	6 – a few times a week
3 – once a month	7 – once a day or more
4 – a few times a month	

3. If you have communicated with someone only on either WORK-RELATED MATTERS or NONWORK-RELATED MATTERS, leave the other column blank.

4. REMEMBER to leave all lines blank for people with whom you have not communicated.

This is an example of part of a filled-out Directory.

EXAMPLE

1 = once a year	5 = once a week
2 = a few times a year	6 = a few times a week
3 = once a month	7 = once a day or more
4 = a few times a month	

DEPARTMENT SERVICES	WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
100 Able, Jill	1 2 3 (4) 5 6 7	1 2 3 4 5 6 (7)
101 Baker, Ronald	1 2 3 4 5 6 7	1 2 3 4 5 6 7
(102 Courtney, Nancy)	1 2 3 4 5 6 7	1 2 3 4 5 6 7
RESEARCH, EVALUATION AND ASSESSMENT SERVICES		
104 Leftland, Joyce	1 2 3 4 5 6 7	1 (2) 3 4 5 6 7

1. Note that Nancy Courtney first circled her own name on the Directory.
2. She next reviewed the list and responded about her communication with Jill Able. She indicated that she communicated with Jill Able a few times a month (4) on work-related matters and about once a day (7) on nonwork-related matters.
3. Note that Nancy has no contact with Ronald Baker and indicated this by not circling any numbers.
4. Nancy continues through the list. She notes that she has no work-related communication with Joyce Leftland by leaving the column blank. But since she does occasionally socialize with Joyce, she circles a (2) indicating that they talk a few times a year.

1 = once a year	5 = once a week
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4 = a few times a month	

		WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
OFFICE OF THE SUPERINTENDENT			
0030	Canja, Alex	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0031	Fleming, Dennis	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0032	Hawkins, Philip	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0034	Miles, Wendy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0035	Miller, Karen	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0036	Paslov, Eugene	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0037	Rekis, Maija	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0038	Ross, Janet	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0039	Runkel, Phillip	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0040	Schultz, Daniel	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0041	Strzelec, Ruth	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0042	Trethewey, Diane	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Program Coordination			
0051	Amundsen, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0052	Cass, Gary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0053	Clemmons, Deborah	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0054	Gordon, Elaine	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0055	Hunter, Marilyn	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0056	Kribs, Barbara	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0057	Lycos, Pauline	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0058	Moreno, Rachael	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0059	Osborne, John	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0060	Schneider, Marilyn	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0061	Slocum, Patricia	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0062	Surline, Wanda	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0044	Worgul, Jean	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Public Affairs			
0001	Carter, Craig	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0002	Farrell, Tom	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0003	Hume, Rosarita	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0005	O'Loane, Jeannine	1 2 3 4 5 6 7	1 2 3 4 5 6 7
School and Community Affairs			
0006	Atkinson, Karla	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0007	Bunton, Peter	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0008	Cullinan, Joan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0009	Dobbs, John	1 2 3 4 5 6 7	1 2 3 4 5 6 7

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		WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
0010	Doty, Peggy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0011	Flores, Antonio	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0012	Gallop, Peggy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0013	Garrett, Vicky	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0014	Gemmill, Lester	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0015	Gordon, Gloria	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0016	Hurwitz, Alan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0004	Jacobs, Jo	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0017	Libey, Susan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0018	Molenda, Patricia	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0019	Reyes, Yolanda	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0020	Ruiz, Diana	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0021	Travis, Cindy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0022	Wing, Nancy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0024	Worthington, Barbara	1 2 3 4 5 6 7	1 2 3 4 5 6 7
State Board of Education			
0025	Dombrowski, Lad	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0026	Gikas, Stella	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0027	Hamilton, Eileen	1 2 3 4 5 6 7	1 2 3 4 5 6 7
BUREAU OF ELEMENTARY & SECONDARY EDUCATION			
0045	Addonizio, Michael	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0047	Hathaway, Douglas	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0048	Parrish, Betty	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0049	Phelps, James	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0050	VanOstran, Rose Mary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Research, Evaluation and Assessment Services			
0064	Bebermeyer, James	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0065	Calabrese, Patsy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0066	Carr, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0068	Caswell, Martha	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0069	Chung, Ki-suck	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0070	Clough, Charlotte	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0686	Coleman, Geraldine	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0687	Crawford, Cathy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0071	Deason, Terri	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0072	Donovan, David	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0073	Ellis, Sherry	1 2 3 4 5 6 7	1 2 3 4 5 6 7

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		WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
0074	Fox, Pamela	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0075	Hanson,. Lois	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0076	Hey, Norma	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0077	Kiefer, Charles	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0078	Kirby, Caroline	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0079	Leland, Irene	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0080	Marshall, Lucille	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0081	Murphy, Morley	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0082	Novak, Paul	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0084	Roeber, Edward	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0085	Rio, Raul	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0086	Schooley, Daniel	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0087	Shakrani, Sharif	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0088	Silver, Jacob	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0090	Vanlooy, Dorothy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0091	Voelkner, Alvin	1 2 3 4 5 6 7	1 2 3 4 5 6 7
School Program Services			
0615	Ruiz, Miguel	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0139	Staten, Teressa	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0146	VanPatten, Muriel	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0151	Wills, Clarence	1 2 3 4 5 6 7	1 2 3 4 5 6 7
School Support Services			
0154	Anderson, Thomas	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0155	Baumgartner, Valerie	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0156	Boguhn, Carol	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0158	Chastine, Deborah	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0159	Claflin, Richard	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0160	Davis, Sandra	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0161	DeRose, Paul	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0162	Ferris, Susan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0163	Godmer, Raymond	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0164	Hampton, Thomas	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0165	Hatch, Joan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0166	Howell, Susan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0167	Iribarren, Miguel	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0168	Janecek, Sally	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0169	Jordan, Janet	1 2 3 4 5 6 7	1 2 3 4 5 6 7

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		WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
0171	Knopp, Jean	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0172	Lamp, Marie	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0173	Loring, Edgar	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0174	Louderback, Lawrence	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0175	Lynas, Roger	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0177	Mullen, Leone	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0178	Murton, James	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0179	Nelson, Claudette	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0180	Nowak, Linda	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0181	O'Leary, Philip	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0182	Osbo, Donna	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0183	Pawelek, Peggy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0184	Peabody, Bonnie	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0185	Perez, Argelio	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0186	Perkowski, Susan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0187	Powtak, Dorothy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0188	Schafer, Joanne	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0189	Singer, Diane	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0190	Slagle, Zoe	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0191	Smith, Duane	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0192	Stratz, Carrie	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0193	Thelen, Darlene	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0194	Turnbull, Ralph	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0195	VanOrden, Colleen	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Special Education Services			
0197	Anderson, Carl	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0198	Bailey, Diane	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0199	Bailey, Susan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0200	Baldwin, Richard	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0202	Baxter, Jan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0203	Beck, Theodore	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0204	Beltran, Lydia	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0205	Bergin, Katherine	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0206	Birch, Edward	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0207	Braccio, John	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0209	Devereaux, Kristy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0210	Dutkowski, Sheryl	1 2 3 4 5 6 7	1 2 3 4 5 6 7

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		WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
0211	Eid, Foster	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0212	Elder, Jean	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0213	England, Hazel	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0214	Fink, Sharon	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0215	Fisher, Marilyn	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0216	Francis, Norman	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0218	Gomez, Joe	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0219	Griese, Shawn	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0220	Herbert, Benson	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0221	Hughes, Delores	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0222	Kitchell, Mary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0223	Kowalski, Sharon	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0224	Kowatch, Sandra	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0225	Law, Harriet	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0226	Livingston-White, Deborah	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0227	MacPherson, Sandra	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0228	Magin, Kevin	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0229	McCrum, Joanne	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0230	Monk, George	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0231	Mroczka, Elna	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0232	Nester, Gerald	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0233	Nuttall, James	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0234	Oakley, Lois	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0235	Parshall, Lucian	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0236	Patterson, Gloria	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0237	Pung, Joyce	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0238	Regnier, Carol	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0239	Richardson, Richard	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0240	Rowell, James	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0241	Rudolph, James	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0242	Scandary, Emma (Jane)	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0243	Smith, Denise	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0244	Smith, Mary Ellen	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0245	Sparks, Craig	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0246	Swegles, Shirley	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0247	Thelen, Sandra	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0248	Thelen, Sharon	1 2 3 4 5 6 7	1 2 3 4 5 6 7

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		WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
0249	Theusch, Cynthia	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0250	Weber, Beth	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0251	Withrow, Kathy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Vocational-Technical Education Services			
0259	Bailey, Phillip	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0271	Gaylor, Barbara	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0282	Jackson, Lola	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0285	Kennon, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0291	Loomis, Arnold	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0292	McGarvey, Joseph	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0297	Pangman, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0308	Shupe, Richard	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0317	Weisgerber, William	1 2 3 4 5 6 7	1 2 3 4 5 6 7
BUREAU OF FINANCE LEGISLATION & PERSONNEL			
0319	Baker, Donna	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0320	McKerr, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0321	Rude, William	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Department Services			
0323	Adams, Helen	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0324	Allen, Timothy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0326	Baker, Steven	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0327	Bannick, Carol	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0328	Banning, Jack	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0329	Bazzett, David	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0330	Beggs, Wallace	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0331	Bellah, Richard	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0332	Bodell, Corlyss	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0333	Bols, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0334	Bombrys, Pauline	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0335	Boomershine, Bess	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0336	Brady, Sandra	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0337	Brewer, Lana	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0338	Briggs, Dale	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0340	Burleson, Evelyn	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0341	Butler, Helen	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0342	Cambell, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0344	Carpenter, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7

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		WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
0345	Constandt, James	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0346	Cook, Harriet	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0347	Cool, William (Ken)	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0348	Corlett, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0349	Craft, Sherry	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0350	Dieterle, Deborah	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0351	Dodge, Sharon	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0352	Doepker, Karen	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0353	Dunn, John	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0354	Dyer, Joyce	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0355	Dyke, Glenda	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0356	Ellison, Janice	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0357	Epple, Susan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0358	Evert, Joy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0359	Fajardo, Kathryn	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0360	Fillingham, Ruth	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0361	Floria, Rick	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0362	Floros, Mark	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0363	Ford, J. L.	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0364	French, Brenda	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0365	Garland, Virginia	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0366	Graves, Edward	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0367	Gray, Terry	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0368	Gustafson, Mary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0369	Hannah, Margaret	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0370	Hanrahan, Daniel	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0371	Harris, Wilhemina	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0372	Hekhuis, Jean	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0373	Holmes, Christina	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0374	Hornberger, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0375	Howell, William	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0376	Huber, Linda	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0377	Jabara, Fayze	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0378	Johnson, Charles	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0379	Johnson, Frances	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0380	Johnson, Patricia	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0381	Kelley, Richard	1 2 3 4 5 6 7	1 2 3 4 5 6 7

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		WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
0382	Kowalk, Carolyn	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0383	Lane, Priscilla	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0384	Laverty, Janet	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0385	Lind, John	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0387	Mahrt, Kimberly	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0388	Matson, James	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0389	Meyer, Ralph	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0390	Milan, Thomas	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0391	McMeans, John	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0392	Moore, Harold	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0394	Myers, Audrey	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0395	Nalett, Emmaline	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0396	Nelson, Daniel	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0397	Nelson, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0398	Nobach, Karen	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0399	Page, Mary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0400	Parker, Max	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0401	Patrick, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0402	Peatee, Geraldine	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0403	Peter, Stephan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0404	Peterson, Lorent	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0405	Phillips, Warren	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0406	Pieters, E. H.	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0407	Priest, Kathleen	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0408	Randall, Jack	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0409	Rogers, David	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0410	Rutter, Mae	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0411	Scabich, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0412	Schafer, Gary Lee	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0413	Schmitt, Amy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0414	Schultz, Martha Lynn	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0415	Sherman, Lewis	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0416	Simpson, Calvin	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0417	Smith, Fred	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0418	Toebe, Carl	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0419	Wager, Walter	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0420	Waite, Clendon	1 2 3 4 5 6 7	1 2 3 4 5 6 7

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		WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
0421	Waldron, Rita Ann	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0422	Waldron, Shirley	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0423	Witte, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0424	Wolfe, Ruth	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0425	Woodruff, Opal	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0426	Wrzesinski, Richard	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0427	Zechinato, Max	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0428	Zimmerman, Elaine	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Office of Legislation and School Law			
0429	McAuliffe, Kathleen	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0430	Schaar, Marjorie	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0431	Vergeson, Sandra	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0432	Widmayer, Patricia	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Office of Personnel Management			
0432	Abbott, Teresa	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0433	Allen, Mildred	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0434	Brazil, Gerald	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0435	Conyers, Walter	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0436	Cunningham, Nancy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0437	Hackney, Connie	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0438	McCaul, Yvonne Lee	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0439	Pearson, Pamela Ann	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0440	Pelkey, Geraldine	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0441	Peston, Norma	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0442	Rice, Jeannette	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0444	Walter, Patricia	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0445	Wojtysiak, Diane	1 2 3 4 5 6 7	1 2 3 4 5 6 7
BUREAU OF LIBRARIES AND ADULT EXTENDED LEARNING			
0447	Kzeski, Rachel	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0448	Ort-Smith, Barbara	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0449	Reiss, Mary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0453	Stokes, Ethel Mary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Adult Extended Learning Services			
0454	Alexe, William	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0455	Beard, Mary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0456	Brown, Orchid	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0457	Clark, Laura	1 2 3 4 5 6 7	1 2 3 4 5 6 7

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		WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
0458	Coley, Raymond	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0459	Columbus, Frederick	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0460	Eldredge, Rebekah	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0461	Gibbs, Billy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0462	Gillum, Ronald	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0463	Henry, Rebecca	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0464	Horton, Devota	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0465	Hughes, Cora	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0466	Jackson, Raymond	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0467	Jackson, Richard	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0468	Johnson, Fred	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0469	Jones, Edward	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0470	Jones, Elodia	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0471	Kleinhans, Marta	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0474	May, Joan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0475	McDaniels, Linda	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0477	Miller, Paul	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0478	Mittag, Mae	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0479	Peterson, Agnes	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0481	Schaefer, Judy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0482	Schmidt, Russell	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0483	Sidel, Kim	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0484	Smith, Richard	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0486	Stern, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0487	VanderVlught, Ralph	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0488	Wallace, Debra	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0489	Walsh, Kenneth	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0490	Weaver, Angela	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0491	Wesley, Suzanne	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Office of Professional Development			
0446	Brictson, Paula	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0450	Rowley, Geraldine	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0451	Sarris, Sharon	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0452	Shaw, Dian Lee	1 2 3 4 5 6 7	1 2 3 4 5 6 7
BUREAU OF POSTSECONDARY EDUCATION			
0495	Folkening, James	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Student Financial Assistance Services			

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		WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
0503	Alvarez, Daniel	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0504	Appel, Walter	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0505	Bachman, Lisa	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0506	Barber, Simona	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0507	Bauman, Monica	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0508	Bellah, Susan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0509	Bentley, Carol	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0510	Bonner, Dolores	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0511	Bristol, Beverly	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0512	Burshaw, Valerie	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0513	Busch, Nancy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0514	Cady, Mary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0515	Christie, Constance	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0516	Compton, Pattie	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0517	Cornell, Jennilee	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0518	Culver, Richard	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0519	Cummings, Patrick	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0520	Cumberworth, Dorothy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0522	Curtis, Dorothy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0523	Dalman, Vicki	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0524	David, Jean	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0525	Davis, Mary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0526	Dean, Debra	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0527	Deluca, Margaret	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0528	Denbrock, Brenda	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0529	Doin, Linda	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0530	Douglas, Kevin	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0531	Edgar, Pamela	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0532	Ensley, Janet (Sue)	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0533	Fashbaugh, Penny	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0534	Fox, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0535	Fronczak, Suzanne	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0536	Gates, Marcia	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0537	Goerge, Margaret	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0538	Graham, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0539	Grimes, Colleen	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0540	Hall, Aaron	1 2 3 4 5 6 7	1 2 3 4 5 6 7

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		WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
0541	Hardin, Martha	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0542	Harris, Thora	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0543	Harvey, Gary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0544	Herrera, Irene	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0545	Hinton, Elizabeth	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0546	Hoekje, John	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0547	Hogan, Faye	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0548	Howe, Terri	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0549	Hurst, Joseph	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0550	Jaskiewicz, N. James	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0551	Jorae, Elizabeth	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0498	Jursa, Ronald	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0552	Keast, Harry	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0553	Keast, Jane	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0554	Koenigsknecht, Agnes	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0555	Lamb, George	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0556	Leonard, Emma (Louise)	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0557	Lewis, Candy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0558	Madav, Jean	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0559	Mariano, Marian	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0560	Martin, Mary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0561	Mather, Donna	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0562	McClean, Mary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0563	Miller, Carol	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0564	Miller, Mary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0565	Montgomery, Thomas	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0566	Nelson, Henry	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0567	Pelkey, Carol	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0568	Peterson, D. Lee	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0569	Pierce, Marlene	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0570	Roat, Rosina	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0571	Robinson, Richard	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0572	Roe, Karen	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0574	Schmitz, Amy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0575	Schrauben, Loretta	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0576	Schroeder, Jane	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0577	Shantz, Dale	1 2 3 4 5 6 7	1 2 3 4 5 6 7

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		WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
0578	Shepherd, Marilyn	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0579	Smith, June	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0580	Smith, Karen	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0581	Smith, Marsha	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0582	Snyder, Glenna	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0583	Sory, James	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0584	Suardini, Rosemary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0585	Taylor, Sarah	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0586	Towsley, Nancy	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0587	Vaillancourt, Tamara	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0588	VanDomelen, Susan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0589	Vanvleck, Mathew	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0590	Vedder, Julia	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0591	Volz, Linda	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0592	White, Patricia	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0593	Williams, Laurie	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0594	Wood, Marcia	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Teacher Preparation and Certification Services			
0596	Bishop, Faith	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0613	Roth, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0144	Trezise, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
BUREAU OF REHABILITATION			
0636	Cotman, Ivan	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0642	Griswold, Peter	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0671	Skiba, Joseph	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0673	Smith, Harry	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Disability Determination Services			
0640	Edmondson, William	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0653	Jones, Charles	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0661	Miller, Mari	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Field Service		1 2 3 4 5 6 7	1 2 3 4 5 6 7
0621	Andringa Larry	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0626	Blalock, Jesse (Ray)		
0630	Bufkin, Judith	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0632	Burke, Jaye	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0633	Byrnes, Crystal	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0638	Eaton, Curtis	1 2 3 4 5 6 7	1 2 3 4 5 6 7

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		WORK-RELATED COMMUNICATION	NONWORK-RELATED COMMUNICATION
0641	Espie, Jean	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0647	Harmon, Lee Anne	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0649	Hiltner, Debra	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0651	Horvath, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0656	Losin, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0657	Mareck, Mary	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0658	Matelsky, Dianne	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0660	McFarlane, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0664	Retzloff, Rae	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0665	Rolfe, Eleanor	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0682	Williams, Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7
Interagency Service			
0622	Antenucci, Basil	1 2 3 4 5 6 7	1 2 3 4 5 6 7
0659	McConnell, L. Robert	1 2 3 4 5 6 7	1 2 3 4 5 6 7

Appendix D

Procedures for Administering Surveys

Procedures for Administering Surveys

1. Two to three hour time blocks will be designated for each service area.

2. Call the Service Area Director the morning before the day you will be on location to remind him/her that you will be coming. Find out where you will be located in the service area (room number, etc.). You may want to talk with the service area director's secretary. Ask that he/she remind the people in the area that the survey is scheduled for the following day and where you will be so they know where to go to pick up the survey.

3. Take with you:
   a. The precoded name lists (labels)
   b. A list of all people in the service area (to identify which people have completed the questionnaire and which ones we need to follow up on).
   c. Enough questionnaires/communication directories for the area (take a few extra).

4. Arrive on site about 15 minutes early. Check in with the service area director (secretary).
   a. She can also help to remind people to pick up the surveys.
   b. She can tell you where you are to be for the next few hours.

5. When people pick up the surveys (if they don't fill them out in a room) note the time they picked up the surveys so you can follow up if you haven't received them in 1 1/2 hours.

6. Contact (secretary could help) all people that haven't picked up the survey in the first 1 1/2 hours.

   If someone is not in the office on that day, note his or her name and leave a preprinted note that informs them of when they can take the survey (keep records on who did not take the survey - we may need to call and follow up) or leave survey with the contact person. Before you leave the service area, you should have a list of all the people that did and did not take the questionnaire/communication directory.

7. While you are in the service area, feel free to talk with people -- you are there to also answer any questions that they may have about the research and the process. You could also ask questions in general about what the area is like and how they feel about the move. (The more credibility, the better - we will probably need their help in the future to fill out the short form.)

8. Give the following instructions:
   a. They should fill out the questionnaires themselves.
   b. Do not discuss the questionnaires with anyone.
   c. These are your opinions - there are no right or wrong answers.

Appendix E

Description of NEGOPY

Description of NEGOPY

NEGOPY is a linkage based pattern recognition network analysis computer program developed by Richards (1974). NEGOPY provides:

1. an indication of direct linkage among dyads;
2. a delineation of groups of communicators based initially on direct linkage;
3. an indication of the group structure and the individual's location in the structure;
4. an assessment of the degree to which links are symmetrical;
5. links which may be unreciprocated; and
6. an indication of significant communication links. (Richards, 1974)

NEGOPY identifies nodes, i.e., individuals, who are participants and nonparticipants in the network. Network participants are either group members or liaisons. Nonparticipants are all others who do not fit into the participant categories, i.e., isolates, tree nodes. The group structure is identified using a density sensitive scanning procedure. After a group is initially detected a checking procedure is used to determine whether the groups created are actually a group rather than two or more groups connected by critical nodes. The group checking procedure specifies:

1. there are at least three members;
2. members meet some percent (alpha percent) or inclusion criterion. This percent specified the proportion of their total linkage that is with other group members;
3. there is a connectiveness criterion at which all members of the group are connected, e.g., two step or four step linkage;
4. there is no single node when removed that causes the group to no longer meet the above criteria; and
5. there is no single link which if cut causes the rest of the group to fail to meet any of the above criteria.

The user of NEGOPY specifies how the network is determined. Links can be specified

as directed or undirected with or without forced reciprocation. Directed links are links that pass something from one node to the other. The link does not imply mutual existence. One assumes something is provided to or passed from one node to another. Reciprocation is the degree to which the the basis for the link (e.g., frequency of communication) is mutual. Reciprocation occurs when both members of the dyad participate in the exchange defining the link. Forced reciprocation assumes a link exists from both parties when only reported by one node in the dyad. It implies that mutuality exists. Role categories are provided that include: group member, liason, isolate, bridge, and tree node. Rice and Richards (1985) describe each of the roles as:

> The *group*, which consists of a set of at least three individuals who have more than half of their interaction with other members of the same set, all of which are connected by some path, lying entirely within the group, to each of the other members of the group. There must be no node or link which, if removed, causes any of the condition not to be met. *Liaisons* are individuals who have most of their interaction with members of groups or with other liaisons, but not with the members of any single group- thus, connecting groups directly or through other liaisons. *Bridges* are group members linked to other groups directly. *Isolates* can have (a) no links, (b) one link to another isolate, or (c) one link to a tree node, group member, or liaison, while not being a member of any other role. A *tree node* is a branching node connected on one end to a tree node or one other role, and on the other end to a tree node or an isolate. (p.130)

The NEGOPY output provides indicators of:

1. the frequency of a dyad's communication;
2. the symmetry of the link;
3. each group member's centrality; and
4. the connectivity of each group;
5. role categories for each node.

For the purposes of this study only the role category of group member was of interest.

Appendix F

Descriptive Statistics

Table F.1. Descriptive Statistics for All Dyads.

Variable	$\bar{x}$	S.D.	Skewness	Kurtosis	Minimum	Maximum	N
Access in the Formal Network (x_1)	.541	.283	1.220	1.808	.091	1.910	713
Access in the Informal Network (x_2)	.992	.782	1.160	.406	0.0	.3697	713
Closeness (x_3)	66.353	28.854	-.705	-.292	0.0	100.0	713
Frequency of Communication (x_4)	118.711	67.781	-.028	-1.022	1.0	232.0	713
Symmetry (x_5)	1.805	.396	-1.543	.383	1.0	2.0	713
Information Value to Others (x_6)	27.556	6.180	-.877	.761	6.0	41.0	712
Information Value to Self (x_7)	24.346	5.956	-.403	.076	6.0	40.0	713
Information Transfer in the Past (y_1)	3.783	4.652	4.887	37.634	0.0	50.0	275
Information Transfer in the Future (y_2)	78.690	25.973	-.951	-.181	0.0	100.0	571

TABLE F.2. Descriptive Statistics for Bridge Dyads.

Variable	$\bar{x}$	S.D.	Skewness	Kurtosis	Minimum	Maximum	N
Access in the Formal Network (x_1)	.753	.311	.388	-.576	.167	1.500	84
Access in the Informal Network (x_2)	.084	.040	1.501	1.458	.0297	.2200	84
Closeness (x_3)	57.512	33.197	-.534	-.882	0.0	100.0	84
Frequency of Communication (x_4)	57.595	55.545	1.188	1.109	1.0	232.0	84
Symmetry (x_5)	1.667	.474	-.720	-1.518	1.0	2.0	84
Information Value to Others (x_6)	28.536	6.195	-.991	.301	12.0	39.0	84
Information Value to Self (x_7)	24.714	6.015	-.314	-.845	12.0	37.0	84
Information Transfer in the Past (y_1)	3.460	3.682	2.731	9.055	0.0	20.0	50
Information Transfer in the Future (y_2)	69.467	24.546	-.258	-.359	2.0	100.0	45

TABLE F.3. Descriptive Statistics for Nonbridge Dyads*.

Variable	$\bar{x}$	S.D.	Skewness	Kurtosis	Minimum	Maximum	N
Access in the Formal Network (x_1)	.497	.264	1.555	3.622	.091	1.910	509
Access in the Informal Network (x_2)	.119	.080	1.035	-.283	.0232	.3697	509
Closeness (x_3)	68.906	27.562	-.773	-.081	0.0	100.0	509
Frequency of Communication (x_4)	138.118	59.319	-.181	-.759	3.0	232.0	509
Symmetry (x_5)	1.851	.357	-1.974	1.903	1.0	2.0	509
Information Value to Others (x_6)	23.896	5.767	.289	-.393	6.0	40.0	509
Information Value to Self (x_7)	27.242	6.011	-.876	.883	6.0	39.0	508
Information Transfer in the Past (y_1)	4.231	5.384	4.577	31.235	0.0	50.0	173
Information Transfer in the Future (y_2)	81.812	24.474	-1.154	.24	10.0	100.0	436

* These are the only dyads in which both members belong to the same group.

TABLE F.4. Descriptive Statistics for Boundary Dyads.

Variable	$\bar{x}$	S.D.	Skewness	Kurtosis	Minimum	Maximum	N
Access in the Formal Network (x_1)	.794	.332	.377	-.570	.216	1.667	132
Access in the Informal Network (x_2)	.069	.049	1.593	3.082	.000	.2445	132
Closeness (x_3)	57.833	33.696.	-.473	-1.041	0.0	100.0	132
Frequency of Communication (x_4)	57.826	53.609	.949	.168	1.0	232.0	132
Symmetry (x_5)	1.742	.439	-1.122	-.754	1.0	2.0	132
Information Value to Others (x_6)	29.424	5.358	-1.151	2.506	7.0	41.0	132
Information Value to Self (x_7)	26.295	5.579	-.219	-.724	14.0	38.0	132
Information Transfer in the Past (y_1)	3.434	3.609	3.111	11.535	0.0	20.0	76
Information Transfer in the Future (y_2)	77.795	24.593	-.785	-.167	2.0	100.0	73

TABLE F.5. Descriptive Statistics for Nonboundary Dyads.

Variable	$\bar{x}$	S.D.	Skewness	Kurtosis	Minimum	Maximum	N
Access in the Formal Network (x_1)	.501	.234	1.491	3.987	.125	1.910	531
Access in the Informal Network (x_2)	.105	.081	1.012	-.044	0.0	.3446	531
Closeness (x_3)	68.279	27.106	-.69	-.136	0.0	100.0	531
Frequency of Communication (x_4)	134.768	62.343	-.205	-.832	2.0	232.0	531
Symmetry (x_5)	1.868	.339	-2.183	2.775	1.0	2.0	531
Information Value to Others (x_6)	28.338	5.024	-.598	.926	12.0	39.0	531
Information Value to Self (x_7)	24.945	5.003	-.121	.183	9.0	40.0	531
Information Transfer in the Past (y_1)	4.053	5.101	4.902	36.211	0.0	50.0	188
Information Transfer in the Future (y_2)	78.692	26.311	-.977	-.171	0.0	100.0	455

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