

ELECTRONIC INTEGRATION: DESIGNING INFORMATION TECHNOLOGY MEDIATED EXCHANGE RELATIONS AND NETWORKS

by

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ABSTRACT

Electronic integration refers to those strategies that apply information technology to transform business processes and relations; the business network or the business scope. In contrast to localized effects from the exploitation of technology to automate existing processes in the firm, electronic integration strategies primarily have an impact beyond the boundaries of the firm. While both researchers and practitioners acknowledge that electronic integration is leading to new forms of industrial enterprise and inter—organizational arrangements, there are no clearly generalizable links between electronic integration and patterns of transformation in inter-organizational arrangements. In this thesis I employ diverse research strategies to study and enrich our understanding of this emergent phenomena as researchers and managers. First, I develop an integrative middle range theory of how electronic integration alters the governance of information technology mediated exchange relations. This theory primarily focused at the level of the dyad, identifies the different dimensions of a governance system and develops a linkage between information, technology and transformations in the governance of exchange relations. Next, I extend the analysis to the level of the network and develop two case studies of business network transformation in a markets influenced by electronic integrations. Specifically, I develop a representation schema to study the effects of electronic integration on business networks, and apply the method to understand transformations in the health care and tax preparation markets. This is used to develop a preliminary theory of how electronic integration effects structures, competition and processes in business networks.

This study contributes to research by clarifying the relationship between electronic integration and transformations in governance; by providing an abstraction technique to aid the study of business network transformation, as well as a preliminary theory of the effects of electronic integration at the level of the network. This thesis contributes to practice by providing theories to guide managers in the effective design of information technology mediated exchange relations and networks, as well as methods to visualize, and systematically understand the effects of electronic integration in their environments.

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Chapter 1: Introduction

Information and information technologies have long been considered critical for effective management (Ackoff 1967; King 1978). Traditionally, information systems have been used to provide support for individual decision-making or automation of routine information processing tasks within an organization. Information systems were used to provide managers with the information inputs required for the internal planning and control decisions (Gorry and Morton 1971) the evaluation of organizational performance (Van de Ven and Ferry 1980), or for the automation of transaction processes such as payroll. According to this perspective, information is a valued resource for decision makers faced with complex tasks, and the design of information systems were focused on providing relevant information and enhancing the efficiency and effectiveness of the decision maker or for automating routine transaction processing tasks. The primary effects of these applications were localized within the boundaries of the firm.

However, new and improved information processing technologies make available new capabilities and strategy options to managers and firms. Indeed, a major reason for the current interest in information technology lies in the use of these new capabilities by firms for electronic integration: the re-engineering of economic production and exchange processes which transform the organization of work within the firm, the social and economic relationships among actors within organizational and inter-organizational networks, and the boundaries of the firm. Electronic integration refers to those strategies that apply information technology to transform business

processes and relations; the business network or the business scope (Venkatraman 1991). Indeed, electronic integration shifts the focus from a localized decision-making and task automation perspective towards a perspective that is centrally focused on the transformation of production roles, and exchange relations between distinct actors or organizations. Distinct actors or organizations are defined as having bases of authority to allocate economic resources independently of each other.

The use of information technology to fundamentally alter the production and exchange processes of firms has made electronic integration a critical strategic management issue. Cash and Konsynski (1985) have identified the role of electronic integration in transforming traditional industry boundaries and Clemons and Row (1988) have illustrated its importance in providing firms with competitive advantage. In addition both researchers and practitioners acknowledge that electronic integration is leading to new forms of industrial organization variously called the "network organization" or the "flexible corporation". Firms implementing these structures are frequently characterized as being less hierarchical and more team based (Drucker 1988; Malone and others 1987), and as shifting from mass production paradigm toward a flexible specialization paradigm for production (Piore and Sabel 1984). Furthermore, these new organizational forms use more external contracting (Antonelli 1988; Malone and others 1987) and are organized to work with a variety of external organizations through strategic partnerships and other modes of relational governance to quickly bring products to market and take advantage of changing markets by collectively leveraging each others strengths.

Despite the emerging consensus on the effects of electronic integration on organizational structures and inter-organizational arrangements, the research evidence is primarily anecdotal and non-generalizable outside of limited contexts. Furthermore, there isn't a comprehensive multi-level theory of how electronic integration transforms exchange relations, or the wider business network comprised of different roles, linkages and actors. Theory development has been constrained by the lack of consensus and inadequate definition of critical constructs.

The objective of this dissertation is to clarify how electronic integration transforms the governance of inter-organizational exchange relations and strategies, structures and processes in business networks. Electronic integration strategies are viewed as causing *technological discontinuities* (Tushman and Nadler 1978) that transform the governance of exchange relations between firms and the structure and functioning of business networks. The practical purpose of this study is to provide managers and researchers with frameworks to understand and conceptualize the effects of electronic integration in order to effectively devise, implement or respond to electronic integration strategies.

To investigate the effects of electronic integration on organizational exchange relations and business network, I employ diverse research strategies to undertake two related studies at different organizational levels. In these studies I develop an integrative framework for the governance of IT mediated exchange relations at the level of the dyad, and a preliminary theory of how electronic integration affects the business strategies and structures at the level of the business network.

Specifically, at the level of the dyad I develop an integrative model of how electronic integration alters the governance of information technology mediated exchange relations. By synthesizing prior theories, I identify key dimensions of governance systems. This is used to identify distinct types of governance systems and develop an integrative theory that clarifies the linkage between electronic integration strategies and transformations of governance requirements and systems implemented to manage inter-organizational exchange relations. This analysis develops a series of propositions on the effects of electronic integration at the level of the dyad and conditions under which fundamental transformations across governance types are likely to occur.

At the level of the business network, I develop two case studies of marketplaces transformed by electronic integration. From a cross case analysis, I develop a preliminary role based theory of how electronic integration transforms strategies, structures and processes in a business network. The preliminary theory is compared to extant theories to develop a more comprehensive understanding of the use and effects of electronic integration at the level of the business network. In addition I propose and use the roles-linkage model as a means for representing and studying transformations in business networks.

The thesis is organized into three parts. In addition to this introduction, section 1 develops a classificatory framework and critically reviews prior research on electronic integration. It outlines the dissertation objectives, modes of inquiry and positions this research in relation to prior research.

Section 2 synthesizes across multiple theories to develop an integrative framework for the governance of IT mediated exchange relations. Section 3 develops and implements the roles-linkage schema to study business network transformation, and applies it to two case studies of business network transformation. The cases are used to construct a preliminary theory of the effects of electronic integration at the level of the network.

The theoretical and practical contributions of this thesis are:

- a critical and classificatory review of research on electronic integration,
- clarification of the concept of governance, identifying key dimensions and characteristics of emergent models of information technology mediated exchange relations,
- an integrative theory clarifying the role of information technology in transforming governance. The theory gives rise to a series of testable propositions for the structuring of exchange relations.
- two descriptive case studies of how electronic integration transforms strategies and structures in business networks,
- a preliminary role based theory of the effects of electronic integration at the level of the network,
- the roles-linkage model as a research and management tool for the representation and analysis of business networks, and guidelines for further research at the level of the network,

- **guidelines for the design of information technology mediated exchange relations and strategic action in business networks influenced by information technology.**

Chapter 2

Electronic Integration - A Critical Review

2.0 Introduction

Research efforts on electronic integration are relatively new with increasing consideration for complex issues in theory construction and empirical methods. In this section we develop a classificatory framework to organize and develop a critical review of the literature.¹ In addition I position the dissertation research in relation to the framework.

2.1 Research on Electronic Integration: A Classificatory Framework

The existing research literature on electronic integration can be organized using a classificatory framework consisting of two dimensions -- (i) the *level of analysis*; and (ii) the *referential frame* adopted for discussion. This framework with representative examples of theories and research is illustrated in the figure below:

¹This framework was developed in discussions with Professor N. Venkatraman

**Figure 2.1:
Research on Electronic Integration: A Classificatory Framework**

Referential Frame	Underlying Theoretical Perspective	Conceptual Frameworks	Case Research	Variance Research
Level of Analysis Focal Actor (Firm)	IO Economics – S-C-P Paradigm (Scherer, 1980) Information Processing (Galbraith, 1977) Coordination Theory (Malone, 1989)	Parsons (1983) McFarlan (1984) Benjamin et. al (1984)	Baxter--AHSC United Airlines American Airlines McKesson (1988)	Venkatraman and Zaheer (1989) Banker et al (1988)
Dyad	Interdependent Value-chains (Porter, 1985) Transaction costs (Williamson, 1975) Game-theoretic perspective (Bakos 1987)	Porter and Millar (1986); Malone et. al (1986); Barrett & Konsynski (1982); Cash and Konsynski (1985)	Aucnet AGMS Estrin & Hart	Nidumolu (1989)
Networks	Social network theory (Cook et. al 1987); Resource Dependence (Pfeffer & Salancik 1979), Political Economy (Benson 1975, Piore & Sabel, 1984)	Antonelli (1990)	Venkatraman and Kambil (1991) Antonelli (1988)	

2.1.1 The Level-of-Analysis Dimension

The level of analysis dimension identifies the specific focus adopted for conceptualizing and investigating the electronic integration strategy. This is a critical dimension as the selection of a particular level of analysis dictates specific theoretical criteria, underlying assumptions, and research methods.

While researchers have adopted several alternate levels of analysis, they can be represented by the following three levels:

- **Focal actor (firm)** – research efforts at this level generally focus on a single actor such as the firm that initiates an electronic integration strategy, emphasizing the effects of the strategy on that specific actor. For example, it is quite common for discussions to focus on the impact of electronic integration on the business activities and performance of firms such as: Baxter – previously American Hospital Supply (HBS 1985; HBS 1988), American Airlines (Harvard Business School case) or United Airlines (Harvard Business School case), with minimal attention to how the electronic integration strategy or system affects relations between the focal firm and other players in the marketplace, or the structure of the marketplace.

- **The Dyad**-- research efforts at this level focus on the relationship between parties connected by the electronic integration strategy. In addition to considering the connection between two actors or roles, research at this level recognizes the differential purposes and effects of the electronic integration strategy on the 'system-deployer' and the 'system-deployed'. From an organization theory point of view, the selection of this perspective generally accords a voluntaristic or strategic choice position (Astley and Van de Ven 1983; Child 1972) to players on both sides of the dyad. Thus, the 'deployed' makes a strategic choice to be electronically integrated with the system-deployer and the integration is not entirely determined by the deployer firm. Thus, in a study of the effects of electronic integration between an airline and a travel agent, the effects on both the airline and the travel agent, as well as the structure or processes associated with their exchange relation would be included in a dyad level analysis.

- **The Network**-- research at this level recognizes the pattern of linkages among multiple economic actors (in addition to the dyad) and how their roles in the business network can be transformed through electronic integrations. The selection of this level of analysis reflects a need to understand the broader impacts of electronic integration strategies on market structures and competition. Thus an assessment of electronic integration strategies in the hospital supply market would at a minimum recognize the existence of three major integrators -- Baxter, Johnson & Johnson and Abbott, and their relationships with customers or suppliers. At the network level the effects of electronic integration on creating new roles and positions in the hospital supply marketplace as well as the competitive effects of the emerging and differential pattern of linkages (electronic and non-electronic) between the integrators and different resource providers and customers would be assessed. Given markets with multiple competing electronic integration strategies, the network promises to be an attractive level of analysis.

2.1.2 Referential Frame Dimension

This dimension refers to the specific frame adopted for research on electronic integration. Four different referential frames are identified. The first frame identifies the underlying theoretical perspective or the relevant parent discipline. In contrast, the other three refer to the specific context or use of electronic integration. The four frames are described below:

- **Theory (parent discipline)** -- refers to the theories that inform research on electronic integration. For example, at the level of the focal firm, key theoretical perspectives include classical industrial organization (IO) economics and theories of monopolistic competition (Scherer 1980; Tirole

1988), while at the level of the dyad, the relevant theoretical perspectives include game-theory, transaction costs (Williamson 1975), information processing and behavioral theories of the firm (Galbraith 1974; Mintzberg 1979). At the network level, the political economy and organizational network perspectives (Benson 1975; DiMaggio and Powell 1983; Piore and Sabel 1984) as well as the transaction costs, and resource dependence theories (Pfeffer and Salancik 1978) emerge as additional relevant frames. This frame is necessary to identify and clarify the link between the underlying assumptions of specific theoretical (parent discipline) perspective and specific research or conceptual frameworks at each level of analysis. Some theoretical perspectives can inform more than one level of analysis. For example the structure-conduct-performance theory may inform the motives for a firm to restructure or diversify, as well as inform us on changes in dimensions such as the relative bargaining power of actors in an exchange relationship.

- **Conceptual Frameworks** – refers to a growing stream of work that propose frameworks to help managers conceptualize the role and effects of electronic integration. For example, the popular competitive strategy framework (Porter 1980) has been adopted as the referent for developing implications for information technology choices (McFarlan 1984; Parsons 1983); the value-chain as a description of business has been used to specify implications for IT (Porter and Millar 1985; Rockart and Scott Morton 1984). In addition, other conceptual frameworks have been proposed as a vehicle to organize the complexity surrounding the potential implications of IT in the marketplace (Cash and Konsynski 1985; Johnston and Lawrence 1988).

- **Case research**— this frame reflects the use of single or multiple case studies to investigate the emerging phenomena of electronic integration. Cases studies are generally used to identify and understand the 'leading-edge' companies and their use of electronic integration strategies. Thus case research tends to primarily be inductive. Case studies include McKesson's *Economost* system (Clemons and Row 1988), American Airlines' *SABRE* reservation systems (Copeland and Mckenney 1988) and Baxter's (previously American Hospital Supply's) *ASAP* system (HBS 1985; HBS 1988). The cases generally provide descriptive validity to the conceptual frameworks, and can be considered complementary to the previous frame.

- **Variance research** -- the fourth frame reflects the empirical studies of electronic integration through multivariate analysis of survey, experimental, archival and other quantitative data. Generally variance research is based on a set of theoretical arguments and proposition used to generate hypotheses. These are then tested through the collection of data and the application of statistical methods to the data, to consider the degree support for the hypotheses. Few studies of electronic integration now fall within this frame (exceptions are: Venkatraman and Zaheer,(1990), Banker et al (1988)). As the field matures this frame could be expected to receive increasing attention.

2.2 Electronic Integration: A Critical Review

Figure 1 is a schematic representation of the classificatory framework with illustrative theories and studies positioned within each cell. An examination of research within specific frames as well as their relationship to other frames in the classificatory framework, can be used to construct a critical review of

prior research as well as identify new research directions. These relate to both horizontal and vertical linkages across cells.

2.2.1 Theories of Electronic Integration

Theories of electronic integration are those that provide *explanations* of the relationships and underlying principles that characterize particular aspects of the electronic integration phenomena. Blalock (1969) defines theoretical explanations to generally consist of a set of statements that describe close associations or causal relationships between influential factors or variables. Useful theories successfully explain and integrate a large number of miscellaneous facts into a small number of coherent relationships.

As illustrated in the classificatory framework above, researchers have adapted a variety of theories to provide explanations of how electronic integration affects inter-organizational relations. For example in a study of electronic integration in the semiconductor manufacturing, Hart and Estrin (1991) use Galbraith's information processing perspective to explain the emerging structure of inter-organizational relations between firms. Alternatively, Bakos (1987) analyzes electronic integration using economic game theory models. Malone et al (1987), and Venkatraman and Zaheer (1990) use transactions costs and agency theory to explain relations arising from electronic integration.

There are many limitations to the current level of theory development on the subject of electronic integration and its effects on inter-firm relations. First, many of these theories are "grand or general theories" that provide sensitizing concepts that alert the investigator to the possible importance of a set of variables. However, grand theories provide us with relatively few

specific propositions that are sufficiently precise to yield testable hypotheses. Theoretical propositions are simple statements that can be investigated using a number of research approaches. Hypotheses are more specific statements of relationships that are phrased such that these relationships can be tested (Blalock 1969). Examples of grand theories include the transactions cost, information processing and coordination theories.

Second, while multiple paradigms may be used to create useful and different images of the phenomena, it also gives rise to a lack of consensus on key constructs or a consistent language to characterize or explain the phenomena. The lack of a dominant paradigm and lack of consensus on relevant constructs and language make it difficult to establish a cumulative body of knowledge.

Third, any individual theory may provide a limited and partial view on the phenomena without adequately capturing its richness, or sufficiently explaining its complexity. Few studies have attempted to integrate across different theories to create a rich explanation, or reconcile the assumptions underlying different theories that pertain to the phenomena

Fourth, although electronic integration can have varied impacts and can be analyzed from multiple levels, issues of *level* have not been explicitly addressed in theory construction or empirical research on electronic integration. Specifically there is no cross-level or multi-level theory (Rousseau 1985) or empirical research that integrates across the three levels of analysis in an internally consistent manner. A multi-level theory or research, specifies and explores the relationships between constructs and variables across different levels. In addition a multi-level theory can be used

to inter-relate theories that apply to specific configurations of variables across different levels. The construction of a multi-level theory of electronic integration is hindered by the lack of consensus on key constructs that are relevant across levels, as well as the lack of a consistent language in the research literature to describe and explain the effects of electronic integration.

Fifth, as electronic integration can lead to completely new forms of organization (Malone and others 1987) a multi-level theory would also have to be a generative theory (Salancik and Leblebici 1988) capable of articulating new forms of electronic integration relations and specifying the principles by which forms are chosen. Existing theories of electronic integration and organization fail to do this

2.2.2 Link Between Underlying Theory and Conceptual Frameworks. While conceptual frameworks are valuable in the initial stages of development of any area of inquiry, we generally observe a *weak link* between existing frameworks and relevant theoretical perspectives or parent disciplines. For example the Industry Competitive Analysis (Porter 1980) framework used to identify strategic electronic integration opportunities is derived from the structure-conduct-performance (SCP) paradigm developed in industrial organization economics. The use of this conceptual framework does not take into account the underlying assumptions of the SCP paradigm. Normative frameworks derived from theory should therefore surface the underlying assumptions of the theory.

2.2.3 Cases for Teaching and Case Research. In discussing the role of case studies, it is necessary to distinguish between cases prepared for teaching and case research (Bonoma 1985; Yin 1981). The latter represent inductive

approaches to understanding the complexity of the phenomenon and constitute a basis for testing or constructing conceptual frameworks and theories. To date there are few instances of the latter in this area (exceptions are Levine, (1987)). This presents the opportunity to develop research cases as a basis for development or falsification of theories and conceptual frameworks.

2.2.4 Variance research. To date there are few systematic statistical tests of propositions derived from theory (or from conceptual frameworks) in this area. Few exceptions to this are the studies of how participation in an automatic teller machines network influences performance in the banking industry as conducted by Banker et al. (1988); a quasi-experimental assessment of the effects of electronic integration in the insurance industry by Venkatraman and Zaheer (1990) and study of the climate of interorganizational relations by Nidumolu (1989).

2.2.5 Inadequate Empirical Attention to the Dyad and Network Levels of Analysis. Prior studies of electronic integration primarily examine the impact of IT on a focal organization and its business processes or alternatively focus on the organizational and technical issues related to the development of such systems. For example Copeland and Mckenney (1988) review the evolution of airline reservation systems primarily from a systems perspective rather than how the business network and business scope of the airlines and travel agents were changed as a consequence of technology adoption. An exception is Venkatraman and Kambil (1991) on the effects of electronic filing in the tax preparer industry. Research at the level of the dyad and the network can

be more complex than at the level of the focal firm. Difficulties arise in terms of methodology and in terms of expense, and access in conducting research across multiple organizations. This is examined in greater detail later in this thesis.

2.2.6 Implications for Research on Electronic Integration

As research on electronic integration is relatively new, there isn't a single dominant paradigm or integrative multi-level theory that guides investigation by identifying and clarifying key dimensions of inter-organizational relations and networks affected by electronic integration. Theories explaining the relation between electronic integration and the structure of inter-organizational relations and networks are varied such there is little consensus on key constructs and dimensions. Often studies derived from a particular reference theory are too narrow in their application and do not adequately address the complexity of the phenomena. Alternatively, the general theories rely on abstract and idealized constructs (e.g. "markets" and "hierarchies" in the transaction cost literature) without an adequate and meaningful empirical definition.

To address the above limitations, research on the effects of electronic integration must focus on building middle range theories (Merton(1968), Pinder and Moore (1980)). Middle range theories "lie between the minor but necessary working hypotheses that evolve in abundance during day to day research and all inclusive systematic efforts to develop a unified theory that will explain all the observable uniformities of social behavior, social organization and social change (Merton 1968)". The intent of a middle range theory is to explain aspects of the phenomena with sufficient clarity and and

concreteness that it can then be applied to several and apparently diverse set of examples of the phenomena. Thus middle range theories emphasize theoretical generalization as well as empirical confirmation.

As discussed earlier the empirical research to date on electronic integration is limited in number as well as scope. Conceptualizing core dimensions, or a set of dimensions for the empirical classification of organizations (McKelvey 1978) is a critical first step in the construction and testing of middle range theories. These can later become the basis for constructing more unified theories of electronic integration.

While there are many approaches to theory and model construction these can be generalized as either primarily inductive or logico-deductive. The former develops theory by analyzing characteristics of a phenomena to determine if there are systematic patterns in the data to be formalized. The latter generally develops a theory by building propositions from specific axioms in a logical and internally consistent manner.

The approaches to theory construction undertaken in this thesis are discussed below.

2.3 Dissertation Strategy and Position.

2.3.1 The Governance of Information Technology Mediated Exchange Relations

This first study focusing on the governance of information technology mediated exchange relations employs the approach of synthesis to frame inquiry into the phenomena. It uses elements of both logico-deductive and inductive approaches. The premises underlying the synthesis approach are

that the phenomena being explained is inherently complex involving multiple interactions of variables rather than simple cause effect relationships. In addition the approach assumes that different theoretical perspectives on the design of organizations can provide valuable complementary insights that help to identify relevant variables and principles of relating variables. The synthesis approach seeks to develop a comprehensive framework to frame inquiry, and explain a phenomena by reconciling the underlying assumptions of prior theoretical formulations, and combining the strengths and minimizing the weaknesses of prior approaches.

In the first part of this dissertation, I synthesize across multiple theories to develop an integrative theory to conceptualize and explore the effects of electronic integration on *governance* mechanisms in dyads and networks of exchange relations between distinct organizations. Specifically I propose that *electronic integration* be considered as a strategy of using information technology to enable and mediate new forms of governing exchange relations. This formulation requires a movement away from a single reference discipline (such as transaction costs) towards one that integrates across complementary reference disciplines such as: economics, behavioral science and sociology (including social networks). By considering the problem of exchange as the transfer of property rights under uncertainty and risk, I synthesize across these disciplines to clarify the key dimensions of governance systems. Governance systems are conceptualized as providing coordination and influence capabilities enabling exchange partners to cope with the uncertainties and risks inherent in complex exchange environments.

Based on a core dimension of governance systems, I specify a typology for the governance of IT mediated exchange relations. This typology is supported through the analysis of case studies on electronic integration. The synthesis of theories is then used to develop an integrative theory and propositions that specify how electronic integration, as a technological discontinuity in an exchange relation can transform governance requirements and capabilities, leading transformations within and across different types of governance. This initial fit model which adapts Tushman and Nadler's (1978) model for structuring relations is considered as an idealized static case model. It is extended by the notion of "set-up costs" which provides an argument for conditions under which successful administrative innovations or transitions in types of governance are most feasible.

The above analysis by identifying critical dimensions of governance and the mechanisms of governance transformation specifies a preliminary middle range theory of how electronic integration transforms exchange relations. While this primarily focuses on dyadic relations, the second part of this thesis extends the analysis to consider the effects of electronic integration at the level of the network. This is briefly summarized below.

2.3.2 Electronic Integration - Transformations and Strategies in Networked Markets.

In contrast to the first part of this dissertation, the second part of the thesis is primarily inductive. The objective of this section is to develop a preliminary understanding of the effects of electronic integration at the level network.

Given the complexity, and the contemporary nature of the phenomena, a case study model of research was employed to study transformations at the level of the network.

Specifically, I undertook two case studies in the tax preparation and health-care markets to develop a detailed description and understanding of the influence of electronic integrations on the changing the boundaries, structure and functioning of these markets. These cases developed through field research, interviews with industry informants and the analysis of published materials are used as a basis for identifying patterns of transformation in networked markets. From a cross case analysis of the two cases I analytically generalize and develop a grounded theory of the effects and use of electronic integration to transform network structures, competition and processes. This theory is stated in terms of a series of propositions. Hence the model of theory construction and the research strategy for this part of the dissertation differs from prior section of this thesis as primarily an inductive and interpretive model of research.

To manage the complexity of analysis at the level of the network it was necessary to develop a formal schema or abstraction mechanism to represent the business network. Hence the roles-linkage model was developed as a means for representing and studying the transformation of business networks. This model is viewed as a critical first tool in the study of networked markets.

2.3.3 Dissertation Position

To summarize this dissertation employs different research methods to generate knowledge about electronic integration. Adapting the research classificatory framework developed earlier, the different parts of this dissertation are positioned to address research areas and limitations identified from the research review. This is illustrated in Figure 2.2.

The purpose of this research is to generate knowledge relevant to academic and managerial practice. The objective of this thesis is to contribute to academic practice by developing a theory that clarifies the relationship between electronic integration and transformations in governance, and by developing an preliminary theory, abstraction and method to research the effects of electronic integration on business networks. The thesis contributes to practice by providing a theory to guide managers in the effective design of information technology mediated exchange relations as well as a method to systematically understand the effects of and take advantage of electronic integration in their environments.

**Figure 2.2:
Dissertation Position**

Referential Frame	Underlying Theoretical Perspective	Conceptual Frameworks	Case Research	Variance Research
Level of Analysis				
Focal Actor (Firm)				
Dyad	Integrative Theory for the Governance of IT Mediated Exchange Relations			
Networks	Preliminary theory on the effects of electronic integration		Case studies and method for the study of electronic integration in business networks	

Section 2

Electronic Integration: The Design of Information Technology Mediated Exchange Relations

Chapter 3: Introduction

Electronic integration is widely acknowledged to be transforming the organization of work within the firm, as well as the management of interdependence between the firm and its environment. Specifically, electronic integration strategies are increasingly deployed to redesign and alter the governance of inter-organizational exchange relations. For example, Malone et al. (1987) identify a shift to electronic markets and electronic hierarchies and propose a generalized shift from hierarchies, to market modes of governance enabled by information technology. In addition, electronic integration strategies enable new modes of governing exchange relations such as value added partnerships (Johnston and Lawrence 1988) and networked markets (Bressand 1990). These transformations are widely acknowledged to be leading to a new form of industrial organization variously called the "network organization" or the "flexible corporation". Firms implementing these structures are frequently characterized as being less hierarchical and more team based (Drucker 1988; Malone and others 1987), and as shifting from a mass production paradigm toward a flexible specialization paradigm for production (Piore and Sabel 1984). Furthermore, these new organizational forms use more external contracting (Antonelli 1988; Malone and others 1987) and are organized to work with a variety of external organizations through strategic partnerships and other modes of governance to quickly bring products to market and take advantage of changing markets by collectively leveraging each others strengths.

However, the relationship between information technology applications and new forms of governing inter-organizational exchange relations remains unclear. For example, while Malone et al (1987) suggest an overall shift towards market modes of governance, Gurbaxani and Whang (1991) suggest the effects of technology on governance are less determinate, and vary based on how technology impacts market transactions and internal coordination costs. A critical review of the literature on information systems and inter-organizational relations illustrates the lack of a comprehensive multi-level theory of how electronic integration transforms exchange relations, or how it transforms the wider business network comprised of different roles, linkages and actors. Indeed, theory construction and empirical research is constrained by the lack of consensus and inadequate definition of critical constructs such as "markets" and "hierarchies". In addition, the prior theories are too general and are not easily operationalized. Hence, the research evidence to date on the relationship between information technology and governance transitions is primarily anecdotal and non-generalizable.

The purpose of this study is to clarify the linkage between electronic integration and transformations in governance systems. I propose that an understanding of the effects of information technology on governance requires a movement away from a single reference discipline towards one that integrates across complementary reference perspectives, including economics, behavioral science, sociology, and political science. In this section I synthesize across these disciplines to develop, define and identify the key determinants and dimensions of governance. Governance systems provide an institutional framework for the management of uncertain exchange relations in a setting of interdependence characterized by individual

incentives for cooperation and opportunism. Specifically governance systems provide inter-organizational coordination and influence capabilities to manage the uncertainties and risks faced by exchange partners.

In this section I construct an integrative model that specifies both the determinants of governance requirements as well as alternative governance mechanisms. The framework is then applied to develop a series of propositions on the effects of electronic integration on different components and types of governance systems. In this preliminary theory, electronic integration is viewed as a technological discontinuity which can transform the information processing capabilities of exchange partners, altering coordination and influence mechanisms thereby leading to new forms of inter—organizational arrangements.

The integrative theory developed in this part of the dissertation is a critical first step in specifying key dimensions and determinants of governance systems. In addition, this section reconciles key assumptions underlying different theories on the design of governance mechanisms and clarifies the relationship between electronic integration and governance. This is a precursor to systematic empirical research on the effects of information technology applications at the level of the dyad and the network. In addition this framework contributes to practice by illustrating governance choices and trade—offs available to managers in the design of IT mediated exchange relations.

This section is organized into six brief chapters. In chapter 4, I develop a model of exchange as a problem solving and information processing activity. This is used to identify the sources of uncertainty and exchange risks that are

managed through the implementation of governance systems. Next, I construct a model of governance systems as a means to coordinate and influence exchange behaviors to resolve uncertainties and attenuate exchange risks. The preliminary model identifies several distinct components of governance systems and develops a preliminary typology of governance.

In chapter 5, I extend the previous models and identify the principles of assigning governance mechanisms to exchange. This is used to specify a generalized model for the governance of exchange relations.

In chapter 6, I develop a preliminary theory of the effects of electronic integration on the transformation of exchange governance. This theory is stated as a series of propositions on the effects of electronic integration on different dimensions of governance requirements and the components and types of governance systems. The propositions are based on the integrative model and the analysis of prior cases of electronic integration.

The chapter 7, I extend and revise the preliminary theory to consider the effects of externalities, coordination mechanisms and accumulation of knowledge on the dynamic of governance transformations.

Chapter 8 presents research conclusions and proposals for research extensions.

The theoretical and practical contributions of this study are:

- clarification of the concept and dimensions of governance systems,

- an integrative theory that specifies how information technology transforms different components and types of governance systems,
- identification of alternative models for the design of information technology mediated exchange relations,
- managerial guidelines for the effective design of information technology mediated exchange relations.

Chapter 4

Exchange and Governance

4.0 Introduction

Electronic integration is widely acknowledged to transform the structure and processes of exchange relations. However, the role of information and information technology in mediating and transforming the nature of exchange relations is still not well understood. This chapter provides a foundation for an integrative theory of how electronic integration affects the governance of exchange relations. Specifically, exchange is defined and identified as a critical activity within and across organizations and an information processing model of exchange is proposed which specifies critical sources of uncertainty and risk in exchange relations. Next, a synthesis across different disciplines is used to identify key dimensions and bases for a typology of governance systems which serve to manage exchange uncertainties and risks.

4.1 Exchange as a Critical Economic Activity

Exchange is a fundamental activity, both within and across organizations. It is defined as the transfer of ownership (property rights), or the rights to control the use of valued items (i.e. the provision of information, advice, tangible goods and direct services) between at least two actors. Actors are interdependent for valued resources but have independent decision making and resource allocation authority. An economic exchange relation exists between actors when they take actions to transfer property, property rights, goods, or services to one another. Such a specification assumes the existence

of a system of property rights. While there can be many different types of exchange relations², this thesis focuses on *voluntary economic or specialized exchange between firms*.

Economic exchange relations between organizations are necessary due to the *interdependence* of organizations on each other for critical resources. This interdependence can exist due to historical patterns of production, as a priori uneven distribution of critical resources and property rights among organizations, or it can be due to the specialization of labor and organizations in order to achieve competitive advantage. Indeed Macneil (1980), proposes that exchange is the "shadow" of specialization. The increasing specialization of labor and production to increase production efficiencies and develop complex goods in modern economies gives rise to the corollary proposition: that efficient exchange is vitally necessary to sustain increasing amounts of specialization, and to promote economic growth and development. Indeed as Adam Smith notes in the *Wealth of Nations*, "the extent of specialization is limited by the extent of the market". Thus the design of effective and efficient of exchange systems is critical in modern economies. Otherwise, the excess product of individual specialists or specialized firms cannot be profitably traded for other goods required to satisfy the specialist's needs or sustain economic growth.

Similarly, the design of exchange relations between firms is a fundamental strategic management issue, as the firm's exchange relations with its environment define its business scope, and reflect specific competitive

²See Blau [1964 #2]. These conceptions are too broad, or alternatively do not specifically recognize the existence of property rights and the necessary institutional context to guarantee these rights.

strategies and choices of internal structure, technology and skills. Given the strategic choice to undertake specific exchanges, parties to the exchange must address three key issues relevant to the design of all economic exchange relations. These are: the means by which value is realized through exchange, the distribution of value among exchange partners, and the governance systems implemented to organize, coordinate and influence the exchange activity and safeguard the interests of exchange partners. The governance systems specify the means to manage interdependence and cooperation between specialized firms.

Research on exchange behaviors and the design of exchange relations is central to contemporary paradigms in sociology, marketing and economics. These disciplines provide partial models, and different explanations or principles for the design of governance systems.

Sociological perspectives of exchange that derive from the psychological studies of Homans (1961) and the sociocultural studies of Blau (1964) and Emerson (1962), typically examine various forms of longitudinal exchange relations, the interpersonal processes between individuals to the exchange and the influence of power, norms and social institutions on the structure of exchange relations. The effects of different exchange structures on equity, distributive justice, power and exploitation are also considered.

Exchange has also been accepted by many researchers as a core concept in marketing (Bagozzi 1975; Hunt 1976; Kotler 1984). Key issues in marketing research on exchange include how to transform exchange events into exchange relationships (Dwyer and others 1987), the design and political economy of channels (Arndt 1983; Heide and John 1988; Hunt 1976; Stern

and Reve 1980), and the effect of non-instantaneous and imperfect information on exchange events, and mechanisms for creating new markets and forums for exchange.

New paradigms in economics, such as the transaction cost perspective, agency theory, and non-cooperative game theory also focus on the factors that characterize and determine the structure of exchange relations between economic actors. These contemporary economic paradigms attempt to incorporate uncertainty, information asymmetries, bounded rationality and opportunistic behavior into the development of economic models that explain the behavior of exchange partners and the structure of inter-firm exchange relations (Winter 1988). Thus there is renewed interest among economic researchers in the comparative efficiency of processes used to communicate information, and to develop, harmonize, sustain and safeguard the interests of exchange partners. In addition there is a consensus on the need to better understand how various institutional structures serve to facilitate exchange (Williamson 1985).

While all exchange activity requires information processing to allow actors to identify, specify, realize and sustain the benefits of exchange relations, the role of information and information technology in mediating and transforming the nature of the exchange relations is still not well understood within the context of any one of the above disciplines. Indeed, the prior research is fragmented into sociological, behavioral, or economic approaches and few attempts have been made in the prior research on information technology and inter-organizational systems to systematically integrate and reconcile approaches. In addition, the prior literature on information technology and exchange does not provide an information processing model of exchange, nor

does it articulate the dimensions and components of governance systems (Swedberg 1990).

In this chapter I model exchange as an information processing and problem solving activity characterized by uncertainty and risk, and I synthesize across complementary reference perspectives including economics, behavioral science, sociology and political science. to develop, define and clarify the key determinants and dimensions of governance. This is a critical first step in developing an integrative model of information technology mediated exchange relations.

4.2 Exchange as Problem Solving Under Uncertainty

Exchange is a complex problem solving activity characterized by uncertainty and economic risks for the exchange partners. The problem to be solved is the exchange of property rights, goods or services such that positive outcomes are likely for both parties to the exchange. The economic risks arise from the uncertainty of exchange partners given bounded rationality, and their inability to foresee and predict all future outcomes associated with the exchange relation.

Exchange partners undertake a variety of information processing tasks to reduce uncertainty and manage risks. As Coase (1937) points out, in order to undertake a "market transaction it is necessary to discover who it is one wishes to deal with, inform people that one wishes to deal and on what terms, to conduct negotiations leading up to a bargain, to draw up a contract, to undertake the inspection needed to make sure that the terms of the contract are being observed and so on". At a minimum this requires three sequential activities: search to gather information and determine products

and parties to transactions, bargaining and negotiations to determine the terms of exchange, and the construction or adoption of monitoring, policing and enforcement mechanisms to ensure parties will satisfactorily perform the exchange (Dahlman 1979). These coordination and influence activities serve to reduce uncertainty and manage economic risks.

This section models exchange as an information processing activity and identifies the types and sources of uncertainty, and the nature of economic risks faced by exchange partners. The next section identifies the elements of governance systems and examines how they provide coordination and influence capabilities to manage cooperation and potential conflict, and reduce uncertainties and risks.

All exchange opportunities are characterized by parametric and structural uncertainty. Adapting Galbraith (1977) and Langlois (1984) we denote *parametric uncertainty* as the difference between the amount of information required by each exchange partner to perform tasks related to production and exchange, and the amount of information possessed by each exchange partner. Hence, parametric uncertainty refers to the absence of information available to exchange partners. Specifically parametric uncertainty refers to the traditional form of uncertainty as defined by the absence of information regarding parameter values in an n-dimensional problem and solution space. Generally the exchange partners know the structure of the problem, as well as the different possible solutions to the problem.

In contrast, *structural uncertainty* refers to uncertainty about the fundamental nature of the problem and its solution space. Given structural uncertainty in an exchange relation, the exchange party is uncertain about which variables

are relevant to the problem and how to resolve the problem. This is synonymous to the notion of equivocality (Weick 1979) in organization theory. *Equivocality* means ambiguity, the existence of multiple or conflicting interpretations about an organizational situation. Thus structural uncertainty refers to the lack of understanding or confusion on the part of exchange partners in relation to the process, as well as issues to be considered in the exchange activity.

Building on behavioral and information processing theories of organization, Daft and Lengel (1986) suggest that different types of uncertainty influence the selection of information processing mechanisms and the construction of organizations. I extend this argument in the following chapters to consider the sources of uncertainty and the influence of different types of uncertainty on the design of inter-organizational governance mechanisms.

Tushman and Nadler (1978) identify three sources of parametric and structural uncertainty in intra-firm relationships. These sub-unit task characteristics, environment and inter-dependence. Adapting the above framework, the sources of uncertainty in an exchange relation include the *product-task* characteristics, the *environment* in which the relation is embedded, as well as characteristics of *interdependence* between exchange partners. Uncertainty arising from these three domains puts the exchange partners at risk. The various sources of uncertainty and factors that affect the level of economic risk are examined below.

Product-Task Uncertainty refers to the uncertainty of buyers and suppliers in determining the features, value and the means by which products to be exchanged will be developed. This uncertainty can arise from information

asymmetries between the buyer and supplier, and its magnitude can vary with *product complexity*, and the *variety* and *analyzability of tasks* required to convert inputs into a product or service for exchange. For example, as products and services exchanged become more complex, the buyer faces increasing uncertainty about their features, attributes and quality. Lack of information about a product may lead to a purchase of a product without the desired features resulting in economic loss. Hence, either the supplier or the buyer must invest in providing or acquiring the relevant information to reduce uncertainty. For custom or specialized products, uncertainty about features, completion dates and value vary with the variety and analyzability of tasks (Daft and Lengel 1986). Analyzability means the degree to which the tasks can be clearly specified to construct a product or service ex ante to the exchange relation.

Environmental Uncertainty refers to uncertainty that arises due the variability of the environment in which both parties exchange. Duncan(1972) and Downey and Slocum(1975) show that environmental uncertainty varies in magnitude and increases as environments increase in *complexity*, *dynamism*, *heterogeneity*, and *hostility*.

As the environment becomes more complex and dynamic in terms of production technologies and markets, uncertainty is increased about the current and future value of the products exchanged, and the likelihood of exchange. Dynamism in factor markets, technological and business environments can result in the rapid obsolescence of products and technology investments, or in the exit of companies from industries. For example, the demise of computer firms such as ComputerVision makes a user's technology investments obsolete. Alternatively, dynamic changes in buyer

environments of product fashions, and buyer preferences can put sellers at risk.

Relational Uncertainty - refers to uncertainty related to managing interdependence between the parties. Given interdependence among exchange partners for resources, the exchange partners can face three substantial areas of uncertainty: the uncertainty and economic risk arising from changing customer preferences or delays by the supplier in providing a good, the risks of opportunism, and the structural uncertainty over the processes for undertaking and maintaining an exchange relation.

Williamson(1985) defines opportunistic behavior as any exploitative action arising from informational and other advantages that are detrimental to the other exchange partner. Three specific types of opportunism that give rise to a variety of strategic economic risks in exchange relations are *adverse selection*, the *moral hazard* and the *hold-up* problems.

Adverse selection takes the form of misrepresenting backgrounds, interests, or capabilities to obtain more favorable terms prior to an exchange. In contrast, the moral hazard problem refers to behavior which may include a reduction in product quality, or failure to perform a service once an agreement to exchange has been signed. The adverse selection and moral hazard problems occur due to information asymmetries and the difficulties and high costs of observing the actions of exchange partners. To mitigate against these risks, actors have to invest in acquiring a priori information about a potential exchange, or must create a system to influence the behaviors of exchange partners to reduce opportunism.

Hold-up problems arise from asymmetric exchange-specific or transaction-specific investments (e.g. information technology) in the exchange relation. These are investments in specialized human and physical assets to support a specific exchange relation. The value of these investments is substantially diminished if the exchange relationship is terminated, or if the investments are to be used outside of a specific relationship. The excess value of the investment over the salvage value of the investment is defined as the quasi-rent generated by the investment (Klein and others 1978). The hold-up problem occurs when an exchange partner exploits the asymmetric pattern of transaction specific investments to appropriate the quasi-rents that derive from the investment. For example, one partner to the exchange can refuse to trade, and thus hold-up the use of a specialized system, to renegotiate new terms for distributing the quasi-rents. Hold-up problems lead to inefficient ex post trading and investment patterns (Tirole 1988).

The magnitude of opportunism risk of partners varies with the relative power of the two parties to the exchange. The greater the relative power of an exchange partner the higher the capacity to effect economic harm to the other party through opportunism. The power of a partner is inversely proportional to the dependence of one party on another for a specific resource (Emerson 1962; Pfeffer and Salancik 1978).

A major source of interdependence uncertainty is the structural uncertainty about the design, construction and selection of structures, routines and processes to undertake the exchange. Expanding on Coase's earlier description of a transaction, the task dimensions of the exchange relation design problem that confronts both buyers and sellers can be identified.

Buyers and sellers face uncertainty in terms of defining the systems for organizing the tasks described in the table 4-1 below.

Exchange related tasks	Purpose of task	Exchange related systems
1 Search	Information processing activities undertaken by exchange partners to identify trading opportunities	Trade search system
2. Communication	The process of exchanging information to support and exchange relation	Access and communication system
3. Product Specification	Information processing undertaken to specify the product features or characteristics	Product specification system
4 Valuation	Negotiation and related information processing to determine the price of the good or service to be exchanged	Price formation/evaluation system
5 Logistics	Negotiation and specification of delivery and transfer of property and property rights	Logistics specification system
6 Settlement	Negotiation and specification of the settlement processes for property transfers	Settlement system
7. Influence	Creation of a system of credible commitments to attenuate the potential opportunism of exchange partners	Commitments, Incentives and sanction system
8. Legitimation	External legitimation or validation of exchange relation	Contracting and Legitimation system
9. Monitoring	Information processing to determine if exchange partners adhere to contract	Monitoring system
10. Dispute Resolution.	Information processing to resolve exchange related disputes	System of decision rights and processes

Table 4-1 Exchange Related Tasks and Systems

Structural uncertainty can exist in how interdependent parties choose to undertake any of the above tasks or specify any of the above systems in order to construct an exchange relation. Governance systems reduce this structural uncertainty by providing a coherent structure that constrains and guides exchange behaviors through a configuration of institutional roles, structures, and routines to effectively implement the above systems. The information processing capabilities inherent in a governance system can be applied to further reduce parametric uncertainty, and parties to the exchange can further reduce structural uncertainties through feedback and adaptation³. In other words, the view here of governance systems is not static but is of a dynamic and evolving social system as exchange partners learn to improve ways of managing interdependence in an uncertain environment.

Finally, the magnitude of parametric uncertainty faced by exchange partners varies with the time required to complete an exchange and the frequency of interaction. As the time frame increases the number of potential outcomes or general uncertainty and risk increases. As the frequency of exchanges with a specific partner increases, the adoption and structuring of inter-organizational routines reduces structural uncertainty.

To summarize, in this section I specified an information processing model of exchange as a problem solving process characterized by two types of uncertainty: parametric and structural. Adapting Tushman and Nadler (1978)

³ Cyert and March in the "The Behavioral Theory of the Firm" provide a model for organizational decision making, which uses feedback from the environment as triggers for organization adaptation and as informational resources for decision making and conflict resolution. See Chapter 6.

I identified three basic sources of uncertainty: the product-task characteristics, the environment in which an exchange relation is embedded, and the uncertainty specific to the relation about potential opportunism and the process of managing a specific exchange relation. Governance mechanisms can reduce structural uncertainty, through various structural and institutional mechanisms that provide coordination and influence mechanisms and constrain exchange behaviors. The information processing capabilities inherent in these structures are applied to reduce parametric uncertainty⁴. In the next part of this chapter I will identify the different elements of a governance system, and the means by which they provide coordination and influence capabilities to reduce uncertainty and manage exchange risks.

4.3 Dimensions of Governance Systems: Constituent Elements

Governance systems are man made institutional frameworks for managing uncertain exchange relations in a setting of interdependence characterized by individual incentives for cooperation and opportunism⁵. Specifically, governance systems provide inter-organizational coordination and influence capabilities to manage the uncertainties and risks faced by exchange partners.

Although there is a significant literature on the governance of exchange relations, the purposes and constituent elements of different governance

⁴Note that Langlois [, 1984 #17] and Hodgson [, 1988 #29] argue that if the problem of exchange was characterized primarily by parametric uncertainty, a contingent contracting framework is adequate for governing an exchange relation.

⁵This definition is partly adapted from Haas's [1983 #1] definition for international regimes in political science. It is interesting to note that Williamson, while dimensionalizing some antecedents of governance structures, does not provide a definition for the concept.

mechanisms are not clearly specified⁶. While markets and hierarchies are considered to be polar opposites as governance mechanisms, Stinchcombe (1990), Hodgson (1988), and Eccles and White(1988) identify that elements of "hierarchies" are found in real markets, and elements of "markets" are to be found in what are often considered hierarchies. Thus the structures and processes that distinguish markets, hierarchies and intermediate models of governance are unclear.

The problem with the current literature is that it often defines the market in terms of an idealized abstraction from an economics textbook that ignores the administrative ingenuity embedded in a market type exchange relation. In addition, the hierarchy is defined in contrast to the idealized version of the market, leaving the features of the hierarchy indeterminate. The result is that neither the market, nor the hierarchy nor intermediate forms of governance adequately defined as separable constructs, or distinguished in terms of constituent elements (Stinchcombe 1990). Indeed, Williamson himself notes the need to dimensionalize what is meant by the concept of governance (Swedberg 1990).

Based on a critical analysis of the emerging literature on governance, I identify six distinct components that characterize governance systems, and provide parties in a dyadic exchange relation with coordination and influence capabilities to address exchange related uncertainties and risks. Coordination - refers to the extra information processing undertaken by two or more actors in order to achieve common goals ⁷. Influence refers to the structuring and

⁶Much of this work follows the work of Coase [, 1937] and Oliver Williamson [, 1975 , 1985], on transactions cost economics.

⁷Adapting Tom Malone's definition of coordination [Malone, 1988]

exercise of authority to affect the exchange behaviors of parties to an exchange relation. Both coordination and influence capabilities are embedded in coordination structures, cooperative processes, systems of credible commitments, incentives and sanctions, and authority which structure the exchange behavior. Finally, any dyadic exchange relation may use third party intermediaries to provide various coordination and influence capabilities.

I now consider how these functional components are structured below:

4.3.1 Coordination Structures

A variety of structural mechanisms are available to firms for information sharing and processing that either provide parties with information or structure the relation to avoid uncertainty.

For example, a formal written *contract* between two parties provides a means for coordination. A written contract can specify the expected outcomes of the exchange relation, the obligations and rights of the parties, and the likely behaviors in the event of different contingencies. The more detailed a contract, the less the need for ad hoc coordination, bargaining, haggling and problem solving in the event of a pre-specified contingency during the course of the exchange relation. The contract reduces structural uncertainty by presentiating various possible ways of dealing with problems and contingencies that arise in an exchange relation⁸. However, contingent contracts are difficult if not impossible to write. Thus other means are required for coordination of parties to the exchange.

⁸Macneil [1980] notes that traditional contracts were based on making exchange relations discrete, and making present the various rights and obligations of parties to the exchange at the time the contract is written.

Organization theorists (e.g., Mintzberg (1979) and Galbraith (1977)) identify a variety of *coordination structures* found within organizations. These include the specification of inter-organizational routines and programs, vertical information systems, and the use of liaison roles, teams, standing committees, and integrative managers. These coordination mechanisms can also be deployed by firms in an inter-organizational setting to enable coordination. Indeed, Thompson (1967) suggests that as the amount of uncertainty facing exchange partners increases, rules and programs must be supplemented by coordination mechanisms which either reduce the need for information through the creation of slack resources, or increase information processing capabilities. While slack resources are not a coordination mechanism they provide organizations with buffers to withstand turbulence and discontinuities in the environment, by reducing coordination and hence governance requirements. In contrast the organizational structures outlined above increase coordination capabilities.

4.4.2 Cooperative Processes

Firms can use the coordination structures to undertake a variety of cooperative processes. This can include information sharing or the provision of private information such as sales data or market forecasts to a supplier to support planning. Second, the parties to the exchange can undertake joint planning activities. This may operational or strategic planning. Joint strategic or operations planning reduces exchange uncertainties by creating expectations of future outcomes or behaviors.

Standardization of activities is a second process by which exchange uncertainty is reduced. This includes the standardization of media and

information to be exchanged, to standardizations of work processes, measurement systems, and equipment across two organizations.

A third process for reducing uncertainty is to provide information through joint and formal training programs. Training, like formal planning activities, can also serve to create shared norms and beliefs about future behaviors. Thus training serves to reduce uncertainty by increasing shared understanding of product, processes, and partners and by creating expectations of future behavior.

4.3.3 Credible Commitments

Credible commitments are actions taken by exchange parties to illustrate commitment to the exchange relation. Credible commitments reduce uncertainty by creating expectations for non-opportunistic behavior by the exchange partner, or *trust* the belief that the other party will abide by prior commitments to complete the exchange. Alternatively they provide guarantees that limit the losses of an exchange partner from opportunism and other breaches of contract.

A variety of means are available to exchange partners to illustrate commitment or contractual solidarity. Credible commitments are generally constructed through irreversible investment in idiosyncratic assets specialized to the exchange relation. These specialized investments may include investments in training, technology and other capital assets (such as siting of plants). The higher the ratio of specialized investment to the expected stream of benefits from the exchange relation, the lower the payoffs from opportunistic behavior, and higher the expectation of fair exchange behaviors. If the investments are not balanced there is the likelihood of hold-

up problems (Heide and John 1988). Williamson (1985) likens investments in credible commitments to the exchange of hostages.

Alternatively, credible commitments may be developed through the provision of enforceable guarantees. These may include legally enforceable warranties, or the provision of funds in escrow accounts to be paid out in the event of a breach of contract.

Third, in the case of repeated transactions between two parties, the perception of commitment and trust in the other party is increased if the other party establishes a clear prior track record of non-opportunistic behavior.

Thus credible commitments influence exchange behaviors by increasing trust and reducing opportunism uncertainty.

4.3.4 Incentives and Sanctions

Incentives and sanctions are positive and negative inducements within the governance system that serve to align the potentially divergent interests of exchange partners and reduce the likelihood as well as attenuate the economic risks of opportunism. Like credible commitments, they reduce uncertainty by creating *trust*. Alternatively they impose sanctions to mitigate opportunism.

The primary positive inducements for participating in and completing an exchange relation are expectations of positive benefits or the maintenance of idiosyncratic investments. For example, if there are mutual benefits to be derived from a long term transaction, two parties are likely to exchange. If both parties have invested considerable specialized assets in the relation,

there is a strong motive to complete the transaction and maintain the value of the assets invested in the relation.

Negative inducements, include the threat of exit, exclusion, or economic or punitive sanction. By exit, the exchange partner has the potential to easily switch to another supplier or buyer, and therefore the threat of exit mitigates against potential opportunism. The threat of exclusion or shunning is used in many exchange settings as a means of attenuating the risk of opportunism (Southard 1981; Willer 1981). For example, stock or diamond trading networks (e.g the New York Stock Exchange or De Beers) can exclude parties from trading in the network if they break the organization's rules. The threat of exclusion or shunning from an exchange system makes it imperative to maintain a good reputation. Thus the sanction of exclusion or denying access to trading opportunities is a powerful means of controlling opportunism. Finally, the threat of economic sanctions such as a direct fine or other punitive sanctions can also provide incentives for non-opportunistic behavior as well as completion of the terms of the exchange.

Different types of incentives and sanctions dominate different exchange relations.

4.3.5 Authority

Closely tied to the operation of incentives in a governance system is the authority to enforce sanctions, or the decision rights to allocate resources in a manner that influences exchange behaviors. Authority is traditionally defined in the organizational literature as legitimate power for seeking the compliance of another party. In any exchange setting the configuration of authority can vary, in terms of whether it centralized or decentralized, or

whether it is intrinsic or extrinsic to parties in the exchange. Authority is vital for influencing the structure and process of exchange activity.

Variations in the distribution of authority can be used to distinguish between the four models of governance identified by Williamson (1985). This is illustrated in the table below:

Table 4.2 The Distribution of Authority and Governance modes:

Authority	Centralized	Decentralized
Intrinsic	Hierarchy	Bilateral Governance
Extrinsic	Trilateral Governance	Market

In a hierarchy, decision rights and the authority to seek compliance of an agent are typically centralized and reside with the principal. The principal has the right, primarily based on the ownership of productive assets, to specify how the agent will perform his or her role in the exchange relation (Grossman and Hart 1986), and to ensure the agent's compliance. The right to resolve disputes rests with the principal.

In bilateral governance, both parties to the exchange own specialized resources and assets valuable to the exchange. This gives both parties the right to specify and influence the behaviors of the other. Authority is decentralized but primarily intrinsic to the exchange relation. Disputes are resolved through negotiation in which both parties have rights to specify the means of

resolution. Exchange relations that deploy bilateral governance systems are often referred to as partnerships or alliances.

Trilateral governance refers to systems of governance that use a third party to arbitrate or resolve disputes, or to specify the rules of exchange. In a trilateral governance system parties to the exchange accept the authority of a third party extrinsic to the exchange relation, or assign their decision rights to an external third party. For example De Beers has strong authority over the access, pricing, trading process and dispute resolution in the exchange of diamonds. Here authority is centralized.

In a market, the authority to bring the exchange partner in to compliance is more limited. Authority is not intrinsic to the exchange relation but is distributed among many different parties. For example, if a supplier sells a poor quality or defective product to a customer and is not willing to replace or repair the product, the customer can seek a court ordering of the dispute, or inform others not to trade with the particular supplier. These strategies require different parties extrinsic to the relation to act in a way that collectively influences the future behaviors of the supplier. In a competitive market scenario, the authority to bring a party in compliance with a specific exchange relation is distributed among many parties extrinsic to the relation.

The distribution of decision rights and authority is a useful basis for constructing a typology of governance. Changes in the distribution of authority can alter the structure of incentives and sanctions, as well as coordination structures and processes implemented in an inter-organizational setting.

4.3.6 Third Party Roles

As highlighted by patterns of authority in an exchange relation, third parties can play a critical role in influencing the nature of a dyadic exchange relation. Specifically, third parties can intermediate the exchange relation and undertake information processing or uncertainty reducing roles that are valuable to both parties in the exchange.

These value adding roles include the provision of communications systems between exchange partners, the provision of information on products or exchange parties, authentication, appraisal, insurance, arbitration, enforcement, or legitimation.

Third parties may provide a means to communicate information between a supplier and a buyer about products and services. This may include advertisements in a newspaper or a specialized search service. Third parties may also provide information on the characteristics of products and services or on specific parties to an exchange. Traditional examples include consumer reports or corporate analyst investment reports. Third parties can also reduce opportunism uncertainty by providing authentication services, to verify that a good being transacted is authentic or of high quality, and also provide appraisal services to reduce price uncertainties. Finally, third parties can help manage exchange risks by providing insurance, or facilitate the exchange process by providing dispute resolution, enforcement or legitimation services. The value adding roles of third parties in information technology mediated exchange will be examined further in later chapters.

4.4 Summary

In this chapter I developed a model of exchange as a complex and essential economic information processing activity undertaken in a setting of uncertainty and risk. I also defined and developed the concept of a governance system as a manmade system that serves to manage exchange relations in a setting of interdependence characterized by individual incentives for cooperation and opportunism. Specifically, I characterized governance systems as a *configuration* of six different dimensions or components: coordination structures, cooperative processes, credible commitments, incentives and sanctions, authority and third party roles. Each of these components provides inter-organizational coordination and influence capabilities by providing information processing capabilities to reduce uncertainty, or by constraining or creating expectations of specific exchange behavior to manage and reduce the uncertainties and opportunism risks faced by exchange partners.

The above specification of governance extends the previous definitions of governance from an economic abstraction to institutional terms, and clarifies the mechanisms that can be implemented by parties to an exchange in order to regulate their exchange behaviors and assure completion of the exchange process. This model forms the basis for developing an integrative framework and assessing the effects of electronic integration on the governance of information technology mediated exchange relations.

In the next chapter I consider the assignment of governance systems to exchange relations. Adapting the above models, and the information processing (Galbraith 1977; Tushman and Nadler 1978) and transaction cost ((Milgrom and Roberts 1990; Williamson 1985) arguments for the design of

specific governance systems, I specify an integrative framework for the governance of exchange relations. In later chapters I apply this framework to examine how electronic integration affects both governance requirements as well as the six dimensions of governance identified above. I examine the effects of electronic integration on governance using a series of case examples and develop propositions on the effects of information technology on governance as well as adapt and extend Williamson's typology of governance for information technology mediated exchange. I also consider the likelihood of transitions from one form of governance to another.

Chapter 5: An Integrative Model for the Governance of Exchange Relations

5.0 Introduction

Managing interdependence in a setting of uncertainty is the critical design problem of two distinct theories of organization design. The information processing theory of organizations develops the view that organization structures and processes are designed to provide information processing capabilities to reduce uncertainty. Similarly, the transaction costs and agency theory perspectives in economics consider the construction of formal governance systems as a means of managing risks associated with opportunistic behaviors of exchange partners and uncertainties of exchange relations projected into the future. In this chapter I develop complementary and generative principles for the design of governance systems through the synthesis of these theories. This is used to specify an integrative model for the design of governance systems and the configuration of governance components specified in the previous chapter. The prior models are also adapted to to specify a typology of governance.

5.1 Designing Governance Systems: An Information Processing Perspective

Building on the work of Thompson (1967), Galbraith (1977) suggests that as uncertainty increases, firms must undertake design actions to reduce the need for information, or to increase the information processing capacities of the organization. Specifically, firms can reduce information processing

requirements by reducing interdependence between sub-units through the creation of slack resources. This allows either more time to respond to external changes, or the capacity to buffer the effects of input or output shocks on the organization. A second organizational design mechanism to reduce information processing and especially communication requirements between task specialists is through work redesign and the creation of self contained tasks. In contrast, information processing capacities of organizations are increased by implementing vertical information systems to support control activities, as well as by designing ongoing lateral relations through task forces, teams and other similar mechanisms for organizational coordination. Weick (1979), and Daft and Lengel (Daft and Lengel 1986) extend the information processing perspective, and propose that organizations are also designed to reduce equivocality. Equivocal information is ambiguous and can lead to multiple and divergent interpretations of situations by exchange partners. Equivocality is reduced when exchange partners negotiate and evolve unambiguous interpretations of previously equivocal issues. More complex coordination mechanisms with richer media are required for resolving higher levels of equivocality.

By adapting the information processing theories of organization design (Cyert and March 1963; Galbraith 1977; Mintzberg 1979; Tushman and Nadler 1978) to an inter-organizational setting, a governance system provides information processing capabilities that enable exchange partners to process information to coordinate and undertake tasks. Effective governance mechanisms reduce uncertainty and equivocality by allowing adequate information exchange between exchange partners to enable optimum coordination. Coordination is achieved when information processing

capabilities of the governance mechanism match the information requirements arising from uncertainty (Tushman and Nadler 1978). Information technology in combination with a variety of coordinative mechanisms ranging from direct liaisons, task forces and joint teams, can increase the information processing capabilities of an organization.

By applying the information processing perspective to the design of governance mechanisms for exchange relations between firms, I derive the following propositions.

5.1.1 Effective governance mechanisms for exchange relations will be those where the information processing capabilities of the governance mechanisms "fits" the information processing or uncertainty reduction requirements of the exchange relation.

5.1.2 As product-task, environmental and relational uncertainties increase, exchange partners will adopt more complex and specialized coordination structures and cooperative processes to manage interdependence.

5.1.3 As product-task, or environmental uncertainties increase, firms will develop and implement more complex cooperative processes for coordination through formal planning and the sharing of previously private information.

For example, as uncertainty in exchange relations increases, we expect the increased use of task forces and teams to coordinate activities across organizations. These systems reflect specialized commitments by both exchange partners in terms of administrative structures that are applied to the management of mutual relations. Firms can also implement a variety of

cooperative mechanisms to reduce uncertainty. These include the implementation of joint planning and information sharing to coordinate activities. Information shared may include stock levels, or market forecasts between a customer and supplier. This information is shared in order to coordinate shipments and to plan for the future commitment of specialized production facilities.

The information processing perspective provides valuable insights in understanding the requirements, functions and coordinative structures that can be employed by governance mechanisms. Specifically, this perspective provides a normative design principle for organizations. Adapting this principle to the setting of exchange relations, effective governance systems require a "fit" between between the coordination and influence requirements that arise due to variations in product-task, environmental and relation uncertainties, and the coordination and influence capabilities that are provided by a specific configuration of governance components identified in the last chapter. The model also suggests the availability of alternative mechanisms for designing exchange relations and for managing interdependence. The choice of coordination and influence mechanisms is not viewed as deterministic, but as determined voluntarily by the exchange partners⁹.

However, there are some critical limitations to the application of the information perspective to the design of exchange relations. First, the information processing view does not consider how different structural mechanisms serve to align incentives and goals, and to constrain behaviors

⁹Markus and Robey (1988) suggest the need for an interactionist perspective.

to reduce uncertainty. Second, the model reduces the entire organization design problem to one of selecting coordination mechanisms for overcoming uncertainty. It does not highlight different types of uncertainty and organizational responses to them. Thus it does not consider how different types of uncertainty affect particular coordination choices, and how influence objectives affect organization design.

Third, the proponents of the traditional information processing perspective following Tushman and Nadler (1978) do not explain how other institutions intermediate and influence either the uncertainty perceived by sub-units or the structure of the inter-unit relationship. In the context of inter-organizational relations, the intermediation of an exchange relation by third parties influences the expectations and uncertainty experienced by exchange partners and hence the choice of coordinative mechanisms. Due to the above limitations this perspective does not adequately or explicitly deal with the other key functions of a governance system. These include the need to attenuate and manage exchange related risks and provide a framework for cooperation and conflict resolution among exchange partners.

Fourth, the model does not tell us how to determine when adequate fit has been achieved. Specifically, the model does not adequately consider the relative costs incurred in the implementation and operation of different organization designs. Tushman and Nadler (1978) recommend that the simple mechanisms be utilized to the fullest possible extent, given the greater costs of the more complex coordination mechanisms. This argument is generally no different in structure from the cost minimizing rationale for firm design as developed by the economic theorists. This design principle is examined below:

5.2 Designing Governance Systems: An Institutional Economics Perspective

Winter (1988) highlights the renewed interest of economists in exchange and information. Economic perspectives on governance focus on designing contracts, incentives and the allocation of decision rights in a manner that efficiently allocates resources and safeguards against exchange related risks. This focus on designing institutional influence mechanisms to constrain exchange behaviors through a combination of contract, incentives, and authority addresses some of the limitations of traditional information processing views of organizations, which primarily focuses on coordination. Influence mechanisms are required to mitigate against exchange related risks such as those that arise from unforeseen contingencies and opportunistic behaviors.

Transaction cost economics¹⁰ is centrally concerned with the question of how to design governance systems for exchange relations. Williamson defines transaction costs as the costs of search, drafting, negotiating and safeguarding a contract, or those costs incurred due to correcting or adapting to contract misalignments, setting arbitration mechanisms or effecting secure commitments. The central tenet of transaction cost economics is that profit oriented firms will organize to economize both production and transaction costs. This provides the second design principle for governance systems: that governance systems will be constructed to economize on production and transactions costs.

¹⁰ Coase [1937] created transaction cost economics by shifting the focus from the firm as a production function, to a mechanism to manage transactions or relations.

Within the general framework of transaction cost economics, two major variations exist to explain variations in governance designs. The first variation, based on the work of Oliver Williamson (1975; 1985) builds on the central premise that any contract that is used to specify an exchange relationship where property rights are to be transferred in the future will be incomplete. Contracts are incomplete, as parties to the exchange cannot anticipate all future contingencies, languages limit the ability to write unambiguous contracts, and information asymmetries and verification difficulties make it difficult to write a contract. Second, even if contracts can be written, the costs of monitoring performance as well as specifying the contract may be greater than responding after the event. The incomplete nature of contracts forces parties to the exchange to construct governance systems as institutional structures and processes to frame the exchange, by providing coordination mechanisms, as well as influence mechanisms which create expectations for performance as well as procedures for decision making.

Williamson's version of the transaction cost theory identifies three critical dimensions that determine the selection of one configuration of governance over another. These are asset specificity, uncertainty and transaction frequency. As discussed earlier, asset specificity refers to the degree to which the asset is specialized to a specific exchange relation, and whose value depends on the continuation of the relation. The higher the amount of sunk investments specialized to a particular relationship, the higher the magnitude of "appropriable quasi-rents" from hold-up (Klein et al,1978). The greater the uncertainty about the future performance of an exchange, or the value of the item to be exchanged, the more difficult it is to write specialized contracts. Hence this requires investment in more specialized and

flexible governance systems. As a transaction is undertaken more frequently, the greater the likelihood of specializing the governance system to economize on transaction costs.

Hence Williamson's basic propositions on the crafting of governance systems can be stated as follows:

5.2.1 As the levels of appropriable quasi-rents and uncertainty in a an exchange relation increase due to asset specificity, firms will invest in increasingly specialized contracts, or construct other specialized institutional and incentive mechanisms to attenuate exchange risks.

5.2.2 As the frequency of exchange relations between firms increase, they will invest in more specialized governance mechanisms in order to achieve efficiencies in coordination and influence activities.

5.2.3 Where the assets held by exchange parties are co-specialized, they will be co-owned to overcome potential hold-up problems and economize on transaction costs.

To summarize: as asset specificity, uncertainty and frequency of exchanges increase, more costly and specialized governance systems are constructed to manage the relations between two parties. These governance systems will be specialized to the dyadic relationship.

While the Williamson model of transaction costs explains why markets fail, leading to the internalization and management of transactions through hierarchy within the boundaries of the firm, it does not explain why hierarchies do not supplant markets. More recent extensions of transaction cost (Milgrom and Roberts 1990) and agency theories (Grossman and

In contrast to a decentralized authority system, when exchange parties are integrated into a single organization under centralized authority there is the problem of over-intervention in transactions by the central authority. Here inefficiencies can also arise as exchange parties invest substantial resources to lobby and influence the central party. This suggests that centralized authority may lead to inefficient allocation of resources.

Hence Milgrom and Roberts propose the following:

5.2.4 In situations that would normally be characterized by asset specificity or problems in measurement leading to unconstrained bargaining, it is better to internalize the transaction within a single organization or under centralized authority. The design principle is to reduce the bargaining costs in frequent and repeated transactions.

5.2.5 Over intervention by central authority and lobbying efforts by exchange parties to influence the central authority can motivate the decentralization of authority.

A related perspective which augments the transactions cost explanation for alternate forms of governance is provided by agency theory. The agency perspective considers the firm to be a nexus of contracts among self interested individuals. These agency contracts exist between the owner of the firm and its employees, all of whom seek to maximize their utility. Agency costs are incurred due to incentive misalignments between the agent and the principal. Specifically, three forms of agency costs are incurred primarily by the principal. *Monitoring costs* are those incurred by the principal in measuring the performance of the agent. *Bonding costs* are losses incurred as

agents seek to reassure the principal of their good intentions and work. The *residual loss* refers to the loss incurred, due to incentive misalignments. In addition, within the organization there are significant internal coordination costs incurred in processing information and communicating between decision makers. The agency perspective argues that organizations should minimize their agency costs.

A variation of agency theory considers the relationship between ownership and incentive alignment. Grossman and Hart (1986) propose that ownership of assets provides the owners with residual claims on profits as well as residual rights of control over the allocation of the asset. Hence ownership is the critical source of authority. They suggest in certain cases that centralizing ownership may be inefficient as it removes efficient production incentives from parties to the exchange who are not owners of the means of production. These parties have no incentive for efficiency as they have no residual claims on the profit. Thus in addition to inefficiencies arising from the intervention of the central authority in decisions, residual losses from incentive misalignments arise when authority is centralized in a firm.

The basic economics design principle is that governance mechanisms should be designed to reduce agency and transaction costs. Institutional economics identifies and highlights the economic costs of coordination, incentive alignments, measurement and losses from imperfect information for decision making or opportunistic behaviors. Specifically, transactions cost economics identifies how asset specificity, uncertainty, frequency, and bargaining behaviors of exchange parties give rise to economic losses requiring the implementation of a governance mechanism to coordinate and influence behaviors to minimize these losses. Institutional economics also

considers how ownership affects the distribution of decision rights or authority and incentive alignments. These in turn affect the economic costs to exchange partners of constructing governance mechanisms.

However, there are some critical limitations to the economic literature.

While highlighting the costs of governance, economics does not dimensionalize the components of governance mechanisms. Furthermore, it proves to be very difficult to operationalize and measure these costs across different systems. In part this problem arises because the concept of transaction and agency costs are broad constructs that do not delineate clearly between bargaining, influence, and various forms of agency and transaction costs. While the literature is useful for identifying costs in a comparative analysis of governance modes, typically analyses are restricted to abstract "markets" and "hierarchies".

5.3 Synthesis and Integrative Model for Governance

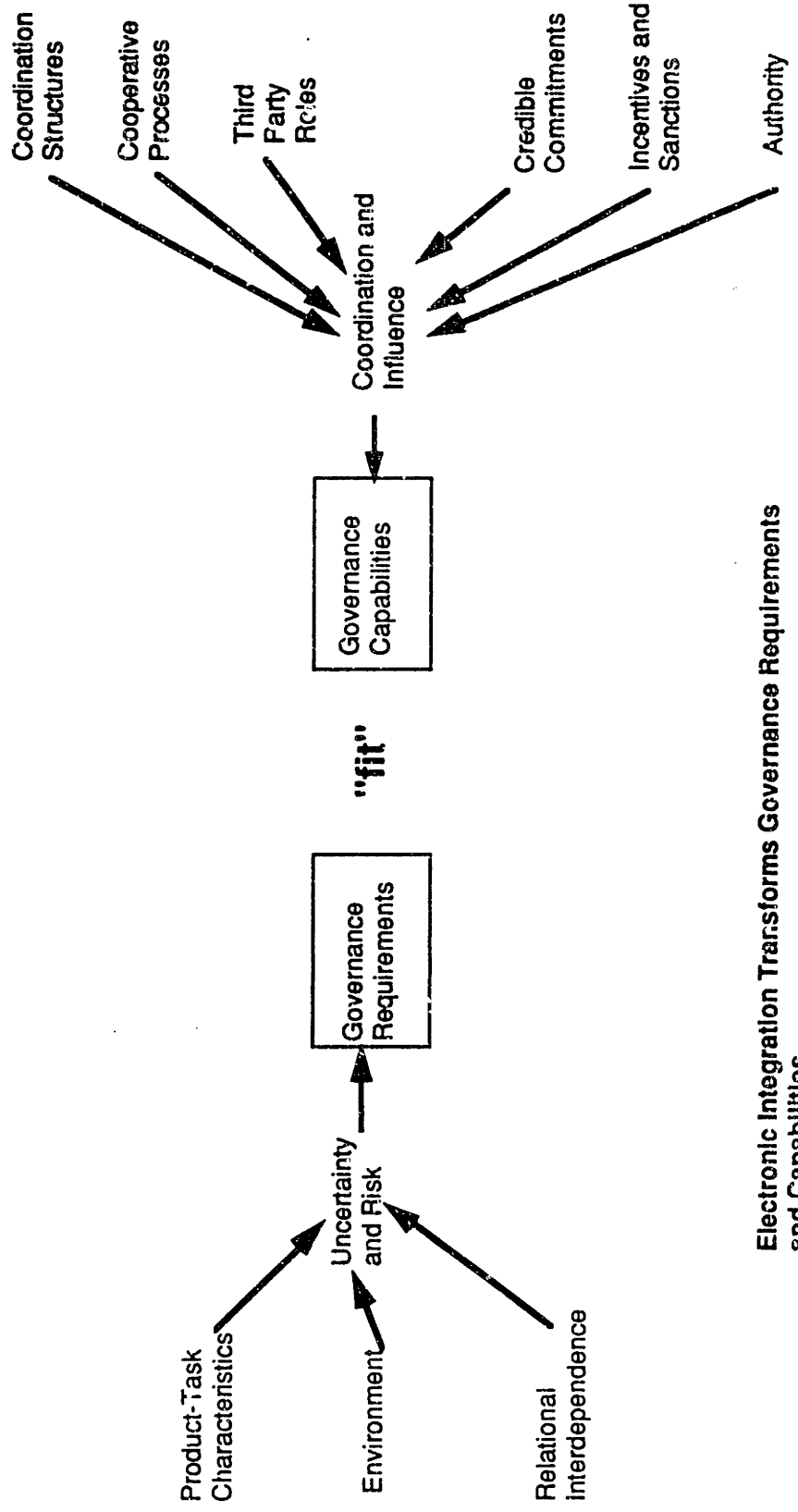
Combining economic and information processing perspectives, the following generative principles for the effective design of governance systems are derived:

- effective governance mechanisms will minimize transaction costs and provide efficient safeguards against exchange related risks that arise from bounded rationality and the potential for opportunism, and
- effective governance mechanisms will meet the coordination and influence requirements of the exchange relation that arise from product-task, environmental and relational uncertainty.

These generative principles specify the objectives for which governance systems are designed. They do not specify how each component of a governance system will be assigned to manage a relation. Instead they imply that a specific configuration of inter-related mechanisms providing governance capabilities will be assigned to the transaction to provide efficient coordination and influence capabilities. Coordination costs refer to the costs of information processing associated with the exchange relation, and influence costs refer to the cost of implementing and operating institutional mechanisms for aligning incentives and constraining exchange behaviors. These configurations will vary along the six governance dimensions discussed in the previous chapter.

Adapting Tushman and Nadler (1978), and building on the contingencies that give rise to governance requirements, and the mechanisms that provide governance capabilities, I define an integrative model for the governance of exchange relations as illustrated in Figure 5.1. Adapting the work of institutional economics, I propose that particular configurations will be constructed which display the greatest cost efficiencies in providing coordination and influence capabilities. The configurational approach (1980; Miller and Friesen 1984) proposes that while there are many possible combinations of the components of governance, certain combinations are much more economically efficient and desirable than others. Hence, I expect there will be specific configurations of governance mechanisms adopted for different exchange relations as firms select those combinations that are more cost efficient and effective at coordination and influence. The next section considers a typology for governance configurations.

Figure 5-1: An Integrative Framework for Governance



Electronic Integration Transforms Governance Requirements and Capabilities

5.4 A Typology of Governance Configurations

One basis for constructing a typology of governance and differentiating among configurations is the allocation of authority to govern dyadic exchange relations. This basis is good as it parsimoniously differentiates among governance types along a critical category. Adapting and extending the work of Williamson (1985) and Macneil (1980), I identify four distinct models of governance, denoted as: **markets, associations, alliances and hierarchies**. Any exchange relation will be characterized by a governance mechanism that fits primarily within one of these dominant categories.

Figure 5.2 The Distribution of Authority and Governance modes:

Authority	Centralized	Decentralized
Intrinsic	Hierarchy	Alliance (Bilateral Governance)
Extrinsic	Association (Trilateral Governance)	Market

As illustrated above, these types differ in the distribution of authority. The remainder of this chapter examines the variation in types, in terms of the six dimensions of governance identified in the previous chapter, as well as their relative advantages and disadvantages in governing different types of transactions. Specifically I consider the characteristics and the relative merits of these different structures.

5.4.1 Markets:

Markets are complex governance systems that manage transactions using a system of decentralized authority that is extrinsic to the parties of the exchange relation. In a market any single party to an exchange has limited direct authority over the actions of another party to the exchange. In addition, the authority to enforce agreements between exchange parties is extrinsic to the exchange relation.

Large numbers of buyers and sellers are required to sustain markets as institutions. The transactions for similar goods between buyers and sellers provide focal points (Schelling 1960) for pricing and valuation, and enables a competitive process. Indeed the possible gains from exchange and the loss from buyers switching to competitors provides the dominant incentives and sanctions in a market to attenuate opportunism. Thus third parties play a critical role in the market configuration by attenuating opportunism through the collective action of competition, or alternatively by intervening as a legal system for dispute resolution. Sustaining the market mechanism also

requires efficient transfer of information and expectations about the quality and value of goods and services.

Coordination structures in markets are typically simple and cooperative processes. They are unlikely to go beyond operational planning for the delivery and use of items exchanged. As the market mode of governance is most frequently used for occasional or recurrent transactions of standardized goods and services, exchanges in markets can be coordinated through simple spot contracts or through implicit or generic contracts (e.g the Uniform Commercial Code).

Markets have many advantages as a means of governing such standard transactions. External production of standard products can be more efficient than production within the boundaries of the firm due to economies of scale available through aggregation of demand (Malone, Yates and Benjamin 1987). Secondly, the competitive process encourages innovations and improvements to products and services.

However, markets become less efficient as goods transacted become more specialized, and where coordination among multiple parties is required for the transaction. As highlighted by transaction cost economists, a key disadvantage of markets arises from inefficiencies incurred due to bargaining and opportunism in the transaction of complex goods. In addition, coordination through market governance is inefficient in the case of market externalities and when multiple parties must be coordinated to make a transaction. As bargaining costs increase, other modes of governance become more efficient.

5.4.2 Associations

Associations are defined as governance mechanisms that centralize key decision rights and authority to a third party external to the exchange relation. The parties to the exchange contract key decision rights to the third party, who can specify the mechanisms for trading, dispute resolution or enforcement of agreements. The centralization and maintenance of authority by a third party is therefore critical to an association model of governance. Third parties can also provide a centralized coordination mechanism by serving as a clearinghouse for critical information.

The third party may assume authority because of ownership of critical assets, or through a legislated mandate. An excellent illustrative example of an association is provided by Milgrom and Roberts of the De Beer's diamond exchange and trading process. De Beers as the dominant diamond producer is able to control trading in diamonds because of its ownership of diamond mines as well as reputation for equity in repeated trading. Associations may also be run by industry trade associations, guilds or regulatory agencies.

Third parties also add value to the exchange process in a variety of ways. For example, they may evaluate the product and specify the price and quality of specialized goods and services to be transacted. This reduces the bargaining costs. Alternatively they may provide arbitration of disputes and monitor the performance of exchange parties. Arbitration can be less costly than litigation and court ordering, and enables ongoing relations during a dispute. In addition to competition, incentives and sanctions against opportunistic behavior in associations include the loss of mutual gains from a specific exchange, loss of reputation and the negative sanction of not being party to a

specialized forum for exchange or future exchange opportunities. The sanction of exclusion from a network is also consistent with sociological methods of controlling the behavior of individuals (Willer and Anderson, 1981). Thus in associations the third party also assumes the role of guarantor and enforcer of the rights of exchange partners.

Associations are especially efficient for reducing search and bargaining costs in the event of infrequent and specialized exchanges that require a medium to a high degree of specialized investments. Such transactions usually incur greater exchange risks, uncertainty and equivocality than typical market transactions. Hence, more complex coordinative mechanisms are likely to be adopted to monitor and manage these relations. More complex contracts delineating the rights of parties to the exchange and arbitration mechanisms are also likely.

Associations can also be efficient for coordinating frequent and complex exchanges between multiple different parties for similar goods. Here, third parties can act as brokers and take advantage of economies of scale in the coordinating exchange activities. Although any two parties to an exchange interact infrequently, they may interact frequently with the third party who specifies processes for exchange and establishes efficient routines to reduce transaction costs.

While associations may be an effective mode of governance in reducing bargaining costs or search and coordination costs, the interests of the third parties can be quite different from those of the exchange partners. This can lead to significant influence costs as particular firms try to influence the policies of the third party, or if the third party intervenes inefficiently in

structuring transactions. In addition, if the volume of transactions is small, or if the transaction is highly specialized between just two parties, it may be economically inefficient to involve a third party. In these cases market, alliance or hierarchical modes of governance are more appropriate.

5.4.3 Alliances

Alliances are defined as governance mechanisms where authority is decentralized and intrinsic to the parties in the dyad. Alliances are appropriate for exchange relations characterized by long and uncertain time horizons, highly transaction specific investments, high uncertainty and equivocality. Alliances are often referred to as partnerships¹¹ (Henderson, 1990) or bilateral governance relations.

Typically, in alliances both parties share in the ownership of transaction risks, residual claims and transaction specific assets. This provides a basis of authority to strongly influence the other party. Disputes are primarily solved through negotiation.

Alliances are especially effective when there is:

- a sense of unity on goals and interests between exchange partners,

¹¹Henderson (1990) provides a detailed managerial process and context model for the implementation of partnerships. The term alliance was chosen to identify this type of governance to focus attention more on the structures of governance rather than the processes, as well as not to confuse this mode of governance with the legal definition of a partnership.

- contractual solidarity reinforced by interdependence and credible commitments (i.e. joint investments in the relationship),
- planning that focuses on the structure and processes required to manage the evolving relationship and see the exchange relation to completion. This is in addition to specification of the items exchanged.

For complex transactions characterized by uncertainty, long duration and asset specific investments, it is inefficient to write detailed contracts to manage the uncertainty and risks. Given more complex governance requirements firms must adopt more complex coordination mechanisms with greater bilateral information processing capabilities than those typically deployed for market and associational modes of governance. Adapting the work of organization theorists (Mintzberg 1979; Galbraith 1977), we can identify a variety of coordination structures and cooperative strategies that alliance can employ to meet the information processing requirements of long term exchange relations. First, exchange partners can implement joint routines, specialized liaison roles, and focused teams as integrative mechanisms to improve the information processing capabilities of the exchange relation. Second, joint planning, and specialized measurement and control systems can be adopted. These serve to inform each party of the other's needs, and to help each other adapt to new situations. The measurement and control systems also serve to assess each party's commitment to the relationship, and facilitates the allocation of costs and benefits. Third, parties can specialize and formalize key integrative roles,

work processes and outputs to reduce task level uncertainty and facilitate exchange. Fourth, joint training and other methods can be used to further develop a system of norms that serve to regulate the relationship. Social norms are a powerful mechanism for aligning incentives and even reducing opportunism.

Given the complexity of the relation, use of third parties to guarantee and arbitrate the relation can be inefficient. Instead exchange partners can use credible commitments (Williamson 1985) to enhance confidence and trust in the ongoing relation. These include specialized investments by both parties. to the the relation to illustrate commitments. Alternatively information sharing can enhance confidence in the relation and facilitate change, thereby reducing costs and delays from inefficient bargaining or court ordering.

A key advantages of alliances are that they reduce and divide the production and exchange risks between both parties. They provide incentives to both parties for efficient production, and provide complex coordination mechanisms. A key disadvantage of alliances is that they themselves constitute specialized investments by firms in the structuring of exchange relations. Their dissolution can therefore be costly to firms. Alliances may also be inefficient in terms of bargaining costs where the incentives of the individual negotiators are not effectively aligned with the organization that they represent.

5.4.4 Hierarchies

Hierarchies, or unified governance, refer to governance systems that centralize authority in one of the parties the exchange. This mode of

governance is primarily relevant for situations of high uncertainty and highly specialized and recurrent exchange, as occurs in a firm.

To meet the information processing requirements of complex exchanges characterized by high uncertainty and equivocality, hierarchies deploy a variety of complex and adaptable coordination structures and cooperative processes, similar to those employed by alliances.

Under this mode of governance one party to the exchange typically retains ownership of the key resources required for production or exchange. Such a relationship can be viewed as a principal-agent relation that employs incomplete contracts. As discussed, earlier the ownership of critical productive resources provides the owner/manager with a specific ordering of authority to manage ex post contractual conflicts. This authority derives from the owner's residual rights of control. Residual rights are the authority to specify the usage of physical or other assets in ways not specified in the initial contract. Ownership of physical assets enables control over human assets, since an employee can be deprived of his or her job and/or the right to utilize assets in a particular way. Thus a key negative sanction or incentive against opportunism is the loss of gains in the agency relation.

The authority arising from ownership can also be exercised to specify the use of assets and overcome traditional ex-post holdup problems. Williamson (1985) proposes that ownership gives the owner the control to specify monitoring systems to measure performance as well as reduce opportunism risks.

There are a variety of advantages to hierarchies, such as the ability to reduce transaction costs incurred from bargaining and the specification of contracts

for complex exchanges. However, hierarchies can be inefficient due to incentive misalignments between principals and agents, and due to residual losses arising from influence activities of agents or the over-intervention of centralized authority in decision making. In these situations alliance modes of governance may be more efficient.

5.5 Conclusions

Information processing and institutional economics perspectives were synthesized to generate design principles and specify an integrative model for the governance of exchange relations. Organizational theorists focus on ensuring fit between coordination requirements and the capabilities of governance mechanisms. Institutional economists focus on the costs of different ways of managing interdependence or exchange relations between parties, as well as the economic merits of alternate ways of configuring the exchange relation to influence behaviors.

Adapting the model of governance developed in the last chapter, four basic types of governance configurations were identified that vary by allocation and location of decision rights and authority. Markets, associations, alliances and hierarchies were identified as specific institutions for governing exchanges. Markets and associations rely on the participation of many parties in providing incentives and sanctions and influence capabilities to manage the dyadic exchange relation. Alliances and hierarchies are more specialized to specific dyads and rely less on external parties to provide influence and coordination capabilities. The variations in institutional structures and processes deployed as coordination and influence mechanisms by these types was further specified in this chapter. In addition, the institutional economics

perspective was applied to consider the relative merits of assigning different types of governance to different exchange relations.

The integrative framework developed in this chapter, is stated as a fit model between exchange characteristics and the various governance choices. Such a fit model is a static model. It did not consider how specialized models of governance may evolve, or how transitions may occur from one model to another. Specifically, it does not identify how electronic integrations can alter the governance of exchange relations.

In the next chapter I consider how electronic integration as a discontinuity in an exchange relation transforms governance requirements and governance capabilities of actors in exchange relations. Specifically I examine the motives for the deployment of inter-organizational systems and the role of electronic integration in altering patterns of coordination and influence in exchange relations.

Chapter 6:

Electronic Integration and Transformations in Exchange Governance

6.0 Introduction

Electronic integration strategies are transforming the structure and governance of exchange relations. Malone et. al. (1987) suggest a generalized shift from hierarchies to markets. Gurbaxani and Whang (1991) suggest the effect is less determinate. The current literature on information technology and governance is also imprecise in the definition of the concept of governance, and does not adequately address the relation between electronic integration and governance type other than markets and hierarchies. In this chapter I examine the motives for electronic integration of the exchange relation, as well as its effects on governance requirements, capabilities and structures. Building on the analysis of previous chapters and the analysis of different case examples, I consider the effects of electronic integration on different governance components as well as different governance types. Specifically, I propose that electronic integration strategies are likely to lead to the increased use of information technology mediated associations and alliances.

6.1 Redesigning Transactions: Motives For IT Mediated Exchange Relations

Electronic integration strategies create value in exchange relations in a variety of ways. Some of the benefits arise from direct changes to the exchange activity, while others accrue from less direct effects of electronic integration on the organization of production or the nature of items and services exchanged. The motivations for electronic integration can be broadly

classified as gains from increased efficiency, effectiveness, and innovation in coordination, influence, production activities and products. These are briefly discussed below:

6.1.1 Efficiency Motives

Efficiency benefits refer to direct gains from performance/price enhancements in communication and computing capabilities that are used to lower the costs of coordination, influence and production activities in the exchange relation. First order efficiency benefits arise from the automation or support of various information processing tasks related to exchange and production. For example, information technology can be used to automate many routine order processing tasks, giving rise to savings in order processing and administrative costs (e.g the use of electronic data interchange systems). In addition, electronic integration can reduce the costs related to procurement and delivery by enabling more efficient search, sorting and routing of products and services procured or delivered. Production savings also arise from reduced inventory, working capital and other slack resource requirements enabled by timely order and just-in-time availability of required inputs. Efficiency gains may also be realized in information processing costs associated with administration and monitoring of the exchange relations.

Second, order efficiency benefits arise from economies of scale, scope and specialization permitted by IT-mediated exchange. Economies of scale are realized when lower per unit costs are achieved by increasing the number of units produced. Malone, Yates and Benjamin (1987) suggest that electronic integration allows exchange partners to benefit from production economies of scale by lowering transaction costs and enabling them to externalize key

production activities to the market. Markets are more efficient at producing standard goods since they are able to aggregate demand and share the fixed costs of production over a larger output. This reduces the unit costs of production. Transaction efficiencies and effectiveness that arise from electronic integration permit firms to manage the externalization of production activities to a market (Brynjolfsson and others 1988).

Economies of scope refer to gains from producing more than one product or service simultaneously. Electronic integration also enables companies to capture economies of scope in markets. Examples include the production of information services where the re-use and bundling of data creates value. For example, an investment broker and tax preparation firm can use tax payer information to identify relevant tax reducing investment products and selectively market them to the tax payer (see chapter 10).

Economies of specialization refer to production gains that arise from the employment of indivisible specialized skills and equipment for production. Electronic integration, through lowering communication and exchange costs, permits trading between exchange partners which was previously inefficient. Thus exchange partners are able to benefit from specialization through the trading relationship.

6.1.2 Effectiveness Gains

Effectiveness refers to direct gains from improvements in the nature and quality of coordination, production and influence activities undertaken by exchange partners.

For example information technology can improve and facilitate planning activities *ex ante* to the actual exchange of a specific good. The use of an HDTV link between designer/buyers at an apparel retail chain in the U.S and their suppliers in Hong Kong enables the exchange partners to discuss and illustrate problems with samples as they fit on American models representative of the U.S market. This enables the exchange partners to resolve design issues prior to mass production and enables the buyer to reduce the time to market, as well as compete more effectively on the basis of better designs. A complementary link of CAD/CAM information also enables the transfer of design modifications to the manufacturer. Thus better coordination and decision making based on information gained through electronic integration can reduce the time required to take products to markets, as well as enable better customization of the products to the needs of each exchange partner.

In addition, better information monitoring capabilities can enable exchange partners to be more responsive to an increasingly turbulent business environment. It enables them to adapt quickly to changes in demand, as well as handling procurement, delivery or production problems. This reduces the risks and costs associated with transactions that fail. In addition, the exchange partners can also ensure the quality of the items exchanged at the time of production of the item, rather than at the time of delivery. This can reduce the costs of retrofitting, renegotiating or even litigating related to problem transactions. Monitoring capabilities can also be used to provide the customer with higher levels of service after the exchange. For example intelligent software diagnostics in products such as computers or elevators can be used to initiate service requests automatically. This can pre-empt

problems prior to occurrence. Gains in exchange efficiency can also lead to improvements in effectiveness by allowing exchange partners the time to focus on exceptions rather than on routine transactions. All of these gains enable firms to provide a higher level and quality of service to their customers.

A second order effectiveness gain is increased monopoly power enabled by electronic integration. Where electronic integration is essential to compete in an industry, electronic integrators can exploit network externalities and economies of scale and scope associated with the network to create barriers to entry (Kambil 1989). These barriers to entry can reduce the contestability of markets, and allow current producers in the marketplace to exercise greater price discrimination and monopoly power.

Inefficiencies also arise from other strategic behaviors by owners of electronic markets and participants in electronic hierarchies. These include the use of restrictive contracts with market participants, and the use of informational advantages to effectively monitor or distort market signals. Levine (1987) shows how CRS systems can be used to reduce the contestability of the airline market.

6.1.3 Product and Service Innovations

Electronic integrations enable firms to deliver new types of products in the marketplace or leverage information technology capabilities to create new exchange relations (enter new markets) or to design new types of value added transactions. For example, in the tax preparation industry, the adoption of electronic filing by the Internal Revenue Service enables tax return preparers

in conjunction with banks, to provide tax refund anticipation loans. The secure features of the electronic integration technology are vital to assure that the tax return has been accurately received by the IRS (Venkatraman 1991). Alternatively, electronic integration enables firms to access entirely new market segments through the use of videotext services (e.g. PRODIGY in the U.S.) and other electronic markets. In addition, new information technology based interfaces permit new ways to represent and advertise product information. These changes can give rise to new sources of revenue.

In addition, firms can create new types of transactions. For example, a home shopping and home banking service can combine transactions such that payment for goods bought is automatically transferred to the shop by the bank when the customer places the order. This new type of service means that the customer does not have to make a separate transaction such as taking out cash from the bank, and paying it to the delivery person for the goods. Thus electronic service networks allow the exploitation in synergies or complementarities from combining previously separate transactions in new ways leading to lower costs of exchange or new ways of differentiating services. Firms can use electronic networks to provide buyers with a unique combination of products and features that exploit demand complementarities. For example, a producer or seller of a CD-player can offer discounts towards the purchase of compact discs from a different firm on the network, and vice versa. Thus electronic markets provide new forums where firms with complementary products can cooperate to compete with others firms unable to exploit demand complementarities. Thus electronic networks can be used to capture economies of scope in distribution that arise from complementarities between products and services.

The examples considered above are illustrative of the benefits and the motivations for electronic integration. The remainder of this chapter examines the effects of electronic integration as a technological discontinuity in an exchange relation. Specifically, its effects on governance requirements and systems are carefully considered to develop propositions on the effects of electronic integration on the governance of exchange relations.

6.2 Transformations in Governance Requirements

Electronic integration transforms governance requirements for managing exchange relations by changing the magnitude and types of uncertainty and risks encountered by exchange partners. An analysis of prior case studies suggests that electronic integration increases governance requirements by changing interdependence and environmental uncertainties. Specifically, reduction in slack resources, increased specialization and investment in the exchange relation and turbulence in the environment arising from other electronic integrations, increase the coordination and mutual influence requirements of exchange partners.

Many firms are implementing just in time production and inventory systems to reduce working capital requirements and inefficiencies arising from holding slack resources (Rockart and Short 1989). As slack resources within a firm are reduced, greater coordination and influence is required with suppliers to ensure timely and adequate delivery of supply. Typically such strategies shift inventory upstream or suppliers have to change their production operations to become more flexible and responsive to rapidly varying market requirements and smaller lot sizes.

Second, as information technology is increasingly applied to improve the coordination of exchange relations, firms are dedicating increasingly specialized investments to specific exchange partners. Again this necessitates increased influence requirements to mitigate against opportunism risks.

A third source of increased uncertainty arises from increased environmental turbulence due to electronic integration strategies undertaken by other actors in the firm's environment. Increasingly information technology is used within the firm to cut down product design times and to provide new variations on an existing product. This increases the product uncertainty faced by buyers, as the time to obsolescence accelerates, and the valuation of products becomes more difficult. Products are also becoming more complex due to technological innovations and changes. Another type of turbulence has to do with collective behaviors in electronically integrated markets. Program trading schemes in the stock exchange result in wide price fluctuations in the stock and indexed futures markets. To respond to these uncertainties managers must implement more specialized coordination and influence mechanisms to track and adapt to more rapid product and price changes and thereby meet their specific requirements.

Hence I develop the following proposition on the effect of electronic integration strategies on governance requirements.

6.2.1 Electronic integration strategies increase governance requirements for exchange partners and necessitate the crafting of more complex governance mechanisms.

6.3 Transformations in Governance Capabilities:

Electronic integration provides firms and managers with new and improved capabilities to manage exchange relations. Specifically, information and technology leverage increase the efficiency and effectiveness of coordination structures and cooperative processes required to coordinate exchanges. In addition economies of scale and the lower costs for exchange related information processing provide new opportunities for third party intermediation of the exchange relation. Transitions and new capabilities for coordination enabled by electronic integration also lead to new patterns of governance through reconfiguration of authority, incentives and sanctions and credible commitments.

Coordination capabilities are improved by leveraging improvements in technologies (performance/price ratio improvements in communication, input/output, storage and processing technologies) and information access. Improvements in communications are especially important. Increased availability of bandwidth, and the capacity for asynchronous distributed wide area data communications allow people to coordinate effectively without collocation in time or space. This enables firms to manage operations effectively over wider geographical areas. Malone et al.(1987) denote this as the electronic communications effect. The impact of this effect is illustrated by the computerization of the London stock exchange. As the exchange was computerized traders shifted from central exchange facilities to offices in their respective firms.

The capacity to use contracts as a coordination mechanism for exchanges is also improved. Cheaper and improved information processing technologies

and information access, reduce the costs of writing, specifying and monitoring detailed contracts.

Improved coordination and communications capabilities make feasible new ways of engaging in cooperative processes. For example, the use of HDTV video-conferencing provides MAST with the necessary rich media and capabilities to effectively coordinate and solve complex design problems with suppliers in Asia. This distributed real time planning enables MAST to better meet its customers needs in a timely fashion. The above capabilities can also be used to improve decision making and influence capabilities. The use of real time inventory and other monitoring systems across organizational boundaries, and other types of information (e.g point of sale data) for planning and evaluating promotional and marketing campaigns can improve decision making and reduce exchange and operations risks to firms.

Third, as the costs of technology drop, and economies of scale in information processing increase, it is increasingly economically feasible for third parties to intermediate the exchange. Third parties can leverage information and technology to provide value added information processing services such as credit databases to improve decision making and reduce exchange risks. Malone identifies this as the electronic brokerage effect.

Indeed, as the costs of technology decrease, electronic integration strategies will diffuse the above capabilities to firms and exchanges will increasingly be mediated by information technology applications. Based on the above analysis I propose the following impacts of electronic integration on exchange relations.

6.3.1. Electronic integration strategies provide improved and lower cost information processing capabilities to exchange parties. This increases the governance capabilities of exchange partners, transforming coordination and influence mechanisms used to manage interdependence.

6.3.2 The electronic communications effect expands the geographic scope of a firm's operations, and its relations with suppliers and buyers. Coordination is increasingly asynchronous and distributed.

6.3.3 Economies of scale in information processing make feasible increased third party intermediation of exchange relations.

6.3.4. Electronic integration results in increased information transfer between exchange parties to reduce exchange risks and uncertainties.

6.4 Transitions and Models of Organizing IT Mediated Exchange Relations:

Changes in governance requirements and the application of new capabilities for coordination, cooperative processes and third party intermediation lead to complex transformations in the patterns of governing exchange relations.

Transformations occur within specific governance types as well as across types altering the configurations of credible commitments, incentives and sanctions, and the distribution of authority in exchange relations. Building on the governance selection model of the previous chapter as well as the effects of electronic integration discussed above, I examine emergent systems of information technology mediated exchange. In contrast to the traditional literature on information technology and governance, which focuses primarily on electronic markets and hierarchies, I propose that there will be a

generalized shift toward electronic associations and information alliances as exchange systems. Below I consider the features and causes of transitions to emergent forms.

6.4.1 Transitions to Electronic Markets

Electronic markets organize information technology mediated exchange using a market mode of governance. An example of an integrated electronic market is a videotext service such as PRODIGY or Minitel, which enables suppliers and buyers to transact standard goods through electronic communications and coordination. Malone et al (1987) predict a general transition from hierarchies toward market modes of governance. They predict that electronic integration, by reducing transaction costs arising from coordination will lead to the development of electronic markets as forums for exchange of goods and services. In addition the communications effect encourages electronic markets by extending the geographic scope and range of trading opportunities made available to buyers and sellers.

These electronic markets will be characterized by the ability of exchange parties to switch easily to alternative suppliers and buyers to attenuate opportunism, simple contracting and dispute resolution through direct negotiation or court ordering. In addition, authority is generally decentralized and external to the exchange parties. Thus in electronic markets the role of the third party or market maker is generally confined to providing common communications standards, electronic network access, and user interfaces for trading activity. The electronic market maker assumes no liability for the items exchanged nor does it provide any other safeguards to facilitate exchange. The market maker essentially rents out electronic facilities to

suppliers and buyers, very much in the way a shopping mall rents out space. Typically, buyers and sellers use general purpose equipment for trading, and lease the services of the third party market maker.

In contrast to the prediction of Malone et al (1987), I propose a very limited shift to market modes of transaction. The evidence of transition to markets as a mode of governance is limited and an examination of many case examples illustrates that firms are more likely to transition to other models of governance. Adapting the fit model from the last chapter, I identify two reasons for a limited shift to electronic markets.

First, electronic integration strategies such as implementing just in time inventories and rapid product cycles actually increase uncertainties, motivating closer bilateral coordination and direct influence activities among actors than is feasible in decentralized market institutions. Second, the electronic media to date is a relatively "lean" and structured media of low bandwidth. It may be inadequate to the task of communicating complex product and design information on the large scale required for effective functioning of electronic markets. Hence while the exchange of relatively standard and well understood goods traded in existing markets will shift to electronic markets, I propose that there will not be a generalized shift to electronic markets. If transaction cost are sufficiently lowered some transactions governed by other models may be externalized to electronic markets.

In summary:

6.4.1.1 Transitions to electronic markets are likely to be limited to those exchanges involving simple and standard goods typically transacted in markets.

6.4.1.2 Transitions to electronic markets are likely to be limited due to the increasing complexity and variation in products and services making valuation and assessment of products difficult over the relatively lean medium of an electronic markets.

6.4.2 Transition to Information Hierarchies

In contrast to electronic markets, *information hierarchies*¹² refer to exchange systems intermediated by information technology and characterized by a centralization of authority to one of the exchange partners. This type governance is typically implemented within a single firm.

Electronic integration strategies enables managers to more effectively monitor and access information across different levels of the hierarchy. The information is primarily used for control, such as inventory control systems and other performance measurement and control systems. These systems reduce the costs of control to owners, or enable the substitution of output control by behavioral control. Firms are increasingly using information technology to centralize control over production and employees.

¹²I have chosen to use the term information hierarchies instead of electronic hierarchies which is used in the prior the literature. This is done to emphasize that information and knowledge acquired through electronic integration enable the increased centralization of authority in certain exchange relations leading to a hierarchical mode of governance. The hierarchy is not primarily based on the leverage of improved information processing technologies as it is based on the leverage of information acquired through the implementation of these technologies.

Hierarchies are especially efficient when exchange partners require specialized coordination and production activities are characterized by high uncertainty. Lateral coordination strategies are also likely to be adopted in hierarchies due to the high task interdependencies, complexities and the long duration for projects completion. However, hierarchies can be inefficient due to incentive misalignments, and inability to take advantage of production economies of scale. I therefore predict that while firms will implement systems to centralized authority to management, there will be increased outsourcing of inputs, and production activities required by the firm.

Hence the following proposition:

6.4.2.1 Information technology will increasingly be used by management to create information hierarchies and support the centralization of authority. These transitions are likely to be limited to those activities which are most critical to the mission of the firm.

6.4.3. Transitions to Electronic Associations

Electronic associations employ the complex method of associations as a governance mechanism for information technology mediated exchange. Many of the examples of electronic markets are more suitably characterized as electronic associations where third parties play a critical role in managing the exchange relation. Examples of associations include the American Gem Market System (Konsynski and Warbelow 1989) which provides an electronic system for trading gem stones, and AucNet (Konsynski and others 1989) a system for trading used cars in Japan. An alternative example is the Petroleum Industry Data Exchange project and the development of electronic integration standards, rules and procedures by the American Petroleum

Institute to enable a simplified cash settlements process for inter-industry oil and gas transactions.

In associations a third party plays a critical role in influencing and intermediating the exchange between two parties. For example on the American Gem Market System (AGMS) , the association maker grades all gemstones traded on the network and certifies their authenticity. In AucNet case association maker provides an independent inspection service of all goods traded on the network and a limited warranty against errors in inspection. Both AGMS and AucNet have substantial authority over parties trading in the network. Given the critical role of the third party, the exchange partners must coordinate operationally and strategically with the association maker.

Incentives and sanctions against opportunistic behavior in associations include the loss of gains from a specific exchange, reputation and the negative sanction of not being party to a specialized forum for exchange or future exchange opportunities. The sanction of exclusion from a electronic trading network is also consistent with sociological methods of controlling the behavior of individuals (Willer 1981). The third party, or arbiter can assume the role of guarantor and enforcer of the rights of exchange partners. An association maker or an independent group affiliated with the association maker or the industry usually provide a set guarantees.

Electronic associations are often created by industry groups such as trade associations to improve the position of a group of companies in the industry.

Exploitation of the communication effect, as well as economies of scale in information processing provide third parties and association makers with the capability to extend to their influence and the magnitude of trading in the association. This mode of governance is especially suitable for occasional transactions of specialized goods which require mixed or highly specific kinds of exchange specific investments, or where exchange partners may have an interest to sustain the relationship, beyond the time frame of a typical transaction. As specialized investments or items to be exchanged can be difficult to value, and contractual specification of rights and obligations expensive, the third parties are used to define the rules of exchange, value exchange items or to arbitrate disputes and monitor performance to reduce transaction and bargaining costs.

Adapting the governance selection models of previous chapters, I propose that inefficient markets will transition into electronic associations in order to reduce bargaining costs. For example, in the case of AucNet, the market for used cars (a well known example of an inefficient market (Akerlof 1970)) was transformed into an electronic association. Here, the role of the market maker in inspecting cars and providing guarantees reduces bargaining and valuation costs among the traders. In addition, electronic communications enables AucNet to take advantage of economies of scale in communication, and to be economically viable by expanding the range of trading opportunities for buyers and sellers.

A second type of transition to electronic associations is observed in the case of American Gem Market Systems. Here, long term trust relations between traders was substituted by the creation of an association. Specifically, the

association enables traders to get the best possible price for a good and again reduces valuation and bargaining costs by centralized grading of gem stones. The associations also provide guarantees that enables traders to substitute discrete relations for longer term trust relations.

Two other reasons motivate the transitions to electronic markets as an efficient governance mechanism for information technology mediated exchange. First, as products and services become more specialized and complex, third parties can play a vital role in valuation and providing guarantees of product and service quality. Second, third parties can take advantage of economies of scale in communications and information processing technologies to provide service in exchange relations. These combine to make third party intermediation more feasible in exchanges. In addition, control of the communication infrastructure as well as access to transaction information can increase the centralization of authority for structuring the exchange to the external third party. Thus information technology and economies of scale enable third parties to concentrate authority.

Hence I specify the following three propositions on electronic integration and exchange.

6.4.3.1 Increased product complexity and specialization, as well as economies in scale in exchange related information processing will lead to increased third party intermediation of exchange relations and the implementation of electronic associations.

6.4.3.2 Transition from markets to electronic associations will occur when the bargaining cost advantage enabled by centralized authority, exceeds the production cost advantages of markets. Thus electronic associations are especially suited for complex and specialized products.

6.4.3.3 Transition from electronic alliances and information hierarchies to electronic associations will occur when the production and bargaining cost advantage of associations exceed influence and production costs of hierarchies and alliances.

6.4.4 Transitions to Electronic Alliances

Electronic alliances use private bilateral ordering of the exchange relation as a mode of governing information technology mediated exchange relations. They differ fundamentally from other modes of governing IT mediated exchange relations, as they employ complex bilateral coordination, information sharing and influence mechanisms characterized by distributed authority. Examples of electronic alliances include various specialized systems initiated by buyers or sellers such as Xerox's links with suppliers, or Baxter's emerging links with hospitals (Short 1992).

Given the inadequacy of relying on independent guarantors or the exchange relation under bilateral governance, Williamson (1985) argues that parties to the exchange must make credible commitments to the ongoing relation to enhance confidence and trust. A variety of strategies can be adopted to develop credible commitments. First exchange partners can make specialized investments, such as investments in information technology to illustrate

commitment to the relation. This can be likened to the creation and trading of hostages to increase interdependence. Alternatively, exchange partners can adopt various specialized structures and processes to plan, adapt and maintain the exchange relationship efficiently. These can enhance confidence in the relation and facilitate change, thereby reducing costs and delays from inefficient bargaining or court ordering. Ex post problem solving in alliances are solved through negotiation. Incentives and sanctions against opportunism are the potential loss of economies associated with specialized investments, and the loss of future exchanges.

Two major transitions in the environment motivate the use of alliances as a means of governing information technology mediated exchange. First, many firms are implementing strategies for tighter coupling across different stages of the value chain to reduce inventories and shorten time to market of products and services. A time and slack reduction strategy necessitates closer coordination and cooperation among parties to the exchange. Electronic alliances provide an adaptable governance system for transactions of long duration and complexity characterized by recurrent exchange transactions projected into the future with mixed levels or high levels of asset specialization. Alliances serve to reduce the costs of slack resources in the value chain.

A second motivation for alliances arises from changes in the underlying technology of different roles. For example, a critical basis for authority in hierarchy was the ownership of the technology and means for production of labour. Today, as knowledge becomes the critical source of competitive advantage and is embodied in the skills of the workforce, using a general

purpose technology such as computers, it is less feasible to develop power through control of technology. Electronic alliances are increasingly favored as a means of managing relations through implementing shared ownership and aligning incentives of different parties to the exchange. Thus electronic alliances can serve to reduce agency costs and gain advantages from better aligned incentives as well as take advantage of production economies of specialization and scale available to external producers.

As electronic alliances are specially crafted governance systems designed to adapt to uncertain contingencies that may arise from innovations, or fluctuations in the demand curves faced by the exchange partners, we expect contracts to primarily serve as a framework for resolving future problems, with specific relational details acknowledged as subject to change. An illustrative example is provided by two international electronics firms, denoted A and B, in the consumer electronics and semiconductor industries. As just-in-time systems for specialized semiconductors were implemented by firm A, it created widely varying and fluctuating demands on the production activities in firm B. Indeed, inefficiencies arose from shutting down and setting-up of production runs in firm B. Firm B, was unsure how to account for these changes in their pricing scheme. To resolve these problems and benefit from the just in time product system, firm A and B agreed to shift the nature of their contracting toward a different longer term basis. Firm A now leased a certain amount of firm B's production capacity rather than specifying product mix and price for each product. Electronic integration through EDI was implemented by firm A to coordinate specific orders and production runs. Hence, the shift to electronic alliances is characterized by less specialized contracts and increased coordination.

6.4.4.1 Electronic integrations that seek to reduce inventory and shorten time to market across different stages of the value chain lead to increased use of electronic alliances as firms adopt more complex coordination structures to manage interdependence and uncertainty.

6.4.4.2 Contracting in electronic alliances will shift from anchoring on product volume, price and mix to anchoring on longer term use of production capacity.

6.4.4.3 Transformation in work technologies and the shift to knowledge based work, reduces the centralization of authority through ownership of assets. Electronic alliances serve to attenuate incentive misalignments.

6.5 Summary

In this chapter I examined the motivations for the use of information technology to mediate exchange relationships as well as the likely impact of electronic integration on the governance of exchange relations. Applying the analytic framework developed in the last chapter as well as the specification of governance types, I predict a generalized shift to electronic associations and alliances in contrast to electronic markets and information hierarchies.

Transitions to electronic associations are favored over transitions to electronic markets because of:

- increasing product complexity and the efficiency of associations over markets in reducing bargaining and valuation costs,
- centralization of authority made feasible through the provision information and information technology in the intermediation of exchanges.

Transitions to electronic alliance are favored over transitions to information hierarchies because of:

- the need to manage complex interdependence as slack resources are reduced in exchange relations
- the need to re-align incentives as technological transformation reduces the viability of concentrating authority through ownership.

The analytic framework applied to develop these propositions was primarily a static framework. In the next chapter I undertake a dynamic perspective and consider factors that may encourage or discourage the evolution of these systems.

Chapter 7

Transitions in Information Technology Mediated Exchange - A Dynamic Perspective

7.0 Introduction:

The previous chapters applied a static framework for a comparative analysis of different governance forms and to analyze the likely effects of electronic integrations on exchange governance. The models predicted a generalized shift toward electronic alliances and associations. In this chapter I adopt a dynamic perspective to examine the processes of transition to electronic markets, associations, alliances and information hierarchies. Transitions among different governance forms are viewed as the adoption of organizational innovations by the different exchange parties. Transitions represent the diffusion and emergence of new consensus standards among exchange parties on the basic structures and processes of exchange. By considering the set-up costs of different organizational forms I develop further support for the propositions that there will be a generalized shift towards electronic associations and electronic alliances. Specifically, the set-up costs of coordinating transitions and aligning the incentives of actors given externalities motivate the transition to electronic associations in preference to electronic markets. The costs of accumulating knowledge or learning is a critical factor that motivates the transition to alliances.

Below I examine the structure of these costs, and consider how they effect the transitions among forms. The adoption and transition to different

governance modes incur different cost patterns which hinder or encourage transitions to specific types of IT mediated exchange.

7.1 Coordination, Alignment and Learning Costs

There are at least three types of costs associated with the adoption of an organizational innovation. Coordination costs refer to the cost of information processing required to achieve consensus and coordinate innovation adoption among exchange parties. Alignment costs refer to the costs of aligning incentives and actions of different actors. Finally, learning costs refer to the costs of accumulating skills, know how and technology within the organization to achieve complex organizational goals.

7.1.1 Coordination Costs

Coordination is required between parties in order to establish a new and complex exchange governance system. Communication is a vital process by which different parties establish consensus on how to change the regulation of exchange behaviors. The costs of coordination for constructing a governance system is in part a function of the number of participants required to adopt the system. In hierarchies and alliances only the parties directly in the exchange need directly coordinate to form a alliance or hierarchy.

However to transition to associations or markets, the exchange parties must coordinate with multiple other parties. Hence coordination costs become a function of N , the number parties required to make the market and association a viable structure. Typically coordination costs for the

construction of associations increase by order $O(N)$, as we assume a third party serves as an association maker. However, coordination costs for constructing markets may vary from $O(N)$ to $O(N^2)$ if there is no third party coordination. Hence, a third party as market maker can reduce the magnitude of coordination costs to $O(N)$.

7.1.2 Alignment Costs

A second factor in the diffusion and adoption of markets and associations is the requirement for a "critical mass" of consensus in a population of traders. A critical mass refers to the subset of the population of traders that are required to transition to a new trading convention of electronic markets or electronic associations in order for these institutions to be successful and sustainable as an efficient governance mechanism. If critical mass is not achieved, the transition to the new mode of exchange is likely to fail, and trading will revert to prior models exchange governance.

The critical mass phenomena arises due to network externalities associated with electronic markets and electronic associations. Externalities refer to interdependencies between actors. For example, the addition of a single new subscriber to a telephone network increases the value of the telephone service to all prior subscribers by expanding the feasible set of services. Similarly the addition of a single new "subscriber" to the electronic market or association generally increases the value of that mode of organizing by expanding the individual range of trading opportunities available to other subscribers. In addition, new subscribers strengthen the regulatory mechanisms in markets by increasing the number of alternatives, and decentralizing authority.

Numerous authors have contributed to our understanding of externalities and critical mass. See for example Allen (1988), Rohlfs (1974), and Markus (1990). Given externalities, the value of adopting a new system of governance depends on how many other actors utilize the system. This makes it important for the early adopters to achieve critical mass quickly and changes the shape of the traditional S-shaped diffusion curve steeper at the point of critical mass. At that point there will a sufficient number of users to motivate other users to join the system, and this motivates the rapid diffusion of the system. Thus the existence of critical mass phenomenon alters the shape of the diffusion curve as well as the requirements of firm actions in order achieve critical mass. If critical mass is not achieved the consensus to transition to the new model of governance will disintegrate and the functioning of the system declines with the departure of subscribers. The functioning of both electronic markets and electronic associations as institutions require a critical mass.

The existence of externalities and critical mass phenomena suggest that a new form of governance may not be widely adopted and sustained even if it is the most efficient form from a static perspective. This necessitates various strategies to lure new users to become subscribers to the network. The first is to encourage the large and influential users to adopt the network. This creates greater expectations of a sustainable transition. Second, a third party can sponsor the transition to the new model by bearing risk and providing a subsidy to new users as incentives to join the system. The subsidy can be eliminated and the costs of the subsidy can be recovered from fees in the rapid

growth stage after the critical mass is achieved. The subsidy is usually provided by a third party as a market or association maker. The subsidy serves as an incentive for new subscribers to join the network and for the network to achieve critical mass (Allen 1988). Other approaches to encouraging the adoption of a new technology under externalities are discussed in (Markus 1990).

Consideration of the coordination costs and subsidies for the alignment of incentives to achieve critical mass suggest significant set-up costs for electronic markets and electronic associations as modes of governance.

7.1.3 Learning

A third factor not considered in the static framework is the delay and opportunity costs of organizational learning, the accumulation of knowledge and skills by exchange partners. This is especially pertinent for transitions to hierarchies and alliances.

The static framework proposed hierarchies as especially appropriate for relations characterized by complex and long term uncertainties. In hierarchies regulatory authority was centralized to one of the exchange parties. While authority is centralized in hierarchies, the effective exercise of authority requires specialized knowledge. This knowledge consists of ways of combining technology and labor for R&D, production and sales. The knowledge is usually accumulated through experience. Indeed many industries have shown an experience curve, where costs are reduced as the amount of production accumulates.

As technological discontinuities result in the convergence of markets, and firms require new skills as well as inputs to compete (see later chapters), it is necessary to either acquire the inputs externally, or develop the inputs within the boundaries of the firm. This provides firms with three alternatives:

- acquire inputs externally, manage through associations and markets
- acquire inputs externally or internally and manage through the use of alliances
- acquire inputs internally and manage through the use of hierarchy.

For the exchange of more complex products and services, alliances and hierarchies are the most suitable governance forms. However, when the firm has little prior experience in producing an input, alliances are likely to be more suitable than hierarchies. This is because of the delays and the opportunity costs associated with developing internal expertise and in efficiently coordinating and integrating the production of these resources within the firms. Alliances by leveraging the existing accumulated expertise of different actors, through a decentralized authority system have an immediate learning or experience curve advantage over hierarchies. Indeed, alliances may also be a useful intermediate step in a transition toward hierarchy. It may also be the most efficient way to transfer technology among exchange actors.

In summary the costs and strategies for learning must be considered in selecting governance types - especially in the transition to hierarchies.

7.2 Implications of Coordination, Alignment and Learning on Governance Transitions

The consideration of coordination, alignment and learning re-affirm the conclusions from the application of the static comparative framework for the selection of governance systems. Consideration of coordination and alignment costs suggest that transitions to associations are favored over markets, and consideration of learning suggest that alliances will be favored over transitions to hierarchies.

Hence the following propositions.

7.2.1. Set-up costs for coordination and alignment of expectations to construct electronic markets are likely to be higher than the set-up costs for electronic associations. Hence transitions to electronic associations are more likely than electronic markets.

7.2.2. Risk bearing and subsidies by third parties to create critical mass for markets and associations will concentrate authority with the third party. This further encourages the formation of electronic associations.

7.2.3 Transitions to electronic alliances will be favored over electronic hierarchies, as alliances are more effective at leveraging the accumulated prior expertise of different actors. Information technology will be used for coordination and control within these structures.

7.2.4 Where firms have no prior expertise in a complex value-adding role, those firms acquiring resources through electronic alliances will have higher performance than those firms who acquire the new inputs through internal

ventures managed through hierarchies. Specifically, electronic alliance strategies will enable quicker time to market and technology transfer.

7.2.5 Alliances are efficient transitional structures as firms bring new capabilities in-house to be managed through hierarchies.

7.3 Conclusions

In this chapter I extended the integrative framework developed in the previous chapters to consider the dynamic of transitions among governance forms. Considering the requirements for coordination of exchange actors, alignment of incentives and expectations, and learning, I propose a generalized shift toward electronic associations and electronic alliances.

Chapter 8

Section 2 Conclusions: Research and Managerial Implications

Exchange is a fundamental and critical economic activity. In this study, I have examined how information technology affects the governance of exchange relations. Governance systems were specified as providing coordination and influence capabilities utilized by exchange parties to manage interdependence and complete transactions. Integrating across institutional economics, organization theory and sociology, various dimensions and a typology of governance was identified. Governance systems were comprised of a complex configuration of: coordination structures, cooperative processes, credible commitments, incentives and sanctions, authority and third party roles.

Building on information processing and institutional economics theories of organization, an integrative theory for the design of governance mechanisms was specified. This theory was applied to analyze the effects of different electronic integration strategies on exchange governance. Electronic integration was identified as having complex effects on exchange governance by simultaneously altering both governance requirements and governance capabilities. For example, electronic integration strategies that reduce slack resources increase exchange risks and vulnerability to environmental uncertainty. At the same time, these strategies provide new coordination and influence capabilities to attenuate exchange risks and manage

interdependence. Thus the effects of electronic integration are neither uni-dimensional nor uni-directional.

In addition to specifying a series of propositions relating the effects of different electronic integration strategies on governance components, the analysis leads to the generalized proposition: that shifts to electronic associations and electronic alliances, will be favored over shifts to electronic markets and information hierarchies. Extensions of the integrative theory from a static framework to a dynamic framework considering the requirements of coordination, alignment and learning in the transition to new governance types provide further support for the above proposition. This is in contrast to the traditional literature on IT and governance, which focuses on electronic markets and electronic hierarchies.

8.1 Research Implications

A key contribution of this study is the identification of different governance dimensions and a more precise specification of governance types than previous research on information technology and governance. Second, the integrative framework provides a series of testable propositions on the effects of different electronic integration strategies on governance components. Together, this forms a basis for future empirical research on information technology and governance.

As the predicted effects of electronic integration are complex, a configurational approach is proposed for the study of electronic integration and governance transitions. Indeed following Miller and Friesen (Miller and

Friesen 1980; Miller and Friesen 1984) an attempt was made to empirically generate a taxonomy of strategy and governance archetypes. Problems in data collection and quality made this infeasible within the scope of this thesis.

While this analysis primarily focused on a dyad, the importance of third party roles highlighted the need to extend the analysis beyond the dyad. Indeed as the effects of electronic integration are typically broader in scope than a specific exchange relation or dyad, it is necessary to extend the analysis to the level of business network. Suitable abstraction mechanisms for business network analysis, and the effects of electronic integration at this level form the remainder of this thesis.

8.2 Managerial Implications:

From a managerial perspective this thesis has identified critical contingencies in the design of information technology mediated exchange relations. It focuses managerial attention on the different dimensions of governance affected by electronic integration as well as the factors affecting transitions across types. In addition the analysis identifies the increasingly important role of third party intermediation in exchange relations as well as some ways in which third parties can create value in an exchange relation through the use of information technology. This provides new business opportunities to firms.

Thus the integrative framework and analysis provide useful managerial guidelines for the effective design of information technology mediated exchange relations.

In conclusion this study provides an integrative framework for the analysis of how electronic integration alters exchange relations and provides useful managerial guidelines for the effective implementation of these strategies.

Section 3:**Electronic Integration: Transformations and Strategies in Networked Markets**

Chapter 9: Introduction

New information processing technologies make available differential capabilities and strategy options to managers and firms. Today these capabilities are being applied to redesign economic production and exchange processes. This is widely acknowledged to be transforming the organization of work within the firm, as well as the boundaries of the firm. For example Piore and Sabel (Piore and Sabel 1984) identify a shift from a mass production paradigm to flexible specialization, and Malone et al. (Malone and others 1987) identify a shift from hierarchies to markets enabled by information technology. In addition to altering firm boundaries (Cash and Konsynski 1985) inter-organizational systems enable managers to construct new industrial structures such as value added partnerships (Johnston and Lawrence 1988) and networked markets (Bressand 1990). These transformations are widely acknowledged to be leading to a new form of industrial organization variously called the "network organization" or the "flexible corporation". Firms implementing these structures are organized to work with a variety of external organizations through strategic partnerships and other modes of relational governance to quickly bring products to market and take advantage of changing markets by collectively leveraging each others strengths.

Electronic integration refers to those strategies that apply information technology to transform business processes, the business network or the business scope. In contrast to localized exploitation of technology to automate existing processes in the firm, electronic integration strategies primarily have

an impact beyond the boundaries of the firm at the level of the business network. As electronic integration strategies are deployed in different markets it is important to shift the focus of strategic planning from a focal firm perspective within a specific industry towards an emergent perspective of strategy at the level of the business network comprising of firms in multiple industries. Network strategy development considers how multiple firms in many different industries can collectively manage interdependence between firms to effectively coordinate and exercise complex collective strategies in "network markets". Hence the new strategic management challenge is to use electronic integration strategies to suitably position the firm in the emerging networked markets and to select suitable mechanisms to manage interdependence with other actors in the network.

To date there are few studies on the effects of electronic integration and information technologies on networked markets. Much of the prior empirical research on electronic integration is based on a focal firm or dyadic perspective. Alternatively the effects of information technology are examined at the level of the overall economy (Brynjolfsson and others 1988). The lack of research on electronic integration and its effects on business network transformation and competition can be ascribed to variety of different causes. In part these include the contemporary nature of the phenomena, the lack of consensus on theory, constructs and conceptual tools to systematically represent and study transformation and competition in business networks, and the costs of undertaking studies of technology applications across multiple organizations in a network. As a result there are few frameworks or tools to help managers understand the effects of information technology in their business networks or to guide decision making or positioning the firm

In addition to this chapter, this section is organized into seven brief chapters which are explained below. The first chapter describes the research method used to investigate electronic integration at the level of the network. The lack of consensus on constructs and tools to represent business networks required the construction of a method to define, represent and investigate business network transformation. The chapter describes the case protocol and develops a preliminary specification of the roles-linkage model which is used in this dissertation to characterize and visualize business network transformation. The model is also used to focus attention on the salient characteristics of business networks that were the subject of this study: business roles and business linkages.

The second and third chapters present case studies that describe electronic integrations and business network reconfigurations in the market place for tax preparation and health care in the United States. The roles-linkage model is used to characterize transformation in these networked markets.

The next chapter develops a preliminary theory of electronic integration and business network reconfiguration from an analysis and comparison of the two cases. This theory is stated as a series of propositions on the effects of electronic integration on roles, linkages, network structure and processes. The cross-case analysis serves to identify common patterns of network transitions as well as identify different types of electronic integration strategies.

The fifth chapter extends the cross case analysis and examines the preliminary theory of the effects of electronic integration in the context of prior theories of strategy and organization. Specifically the preliminary theory is refined and

extended through comparison with three complementary theoretical perspectives that provide partial and useful explanations of how and why firms implement electronic integration strategies.

The sixth chapter develops critical evaluation of the roles-linkage model based on the field research and proposes approaches for its extension and modification as a tool to effectively visualize strategies and transformations in business networks. The seventh chapter summarizes the key findings and conclusions of this study.

The contribution and outputs of this study are the following:

- **Case examples:** The case examples provide a description of how electronic integration strategies are deployed in and are transforming two distinct markets.
- **Propositions:** Analysis of the cases identifies several major effects of electronic integration on the business network. These propositions provide hypotheses for follow-on research on the effects of electronic integration.
- **Representation:** The roles-linkage model provides a representational schema for characterizing business networks.
- **Process:** Lessons from the field inform the process for defining roles-linkage models and their use to represent and visualize strategies in business networks.

This study is therefore viewed as a preliminary step in the development of a theory of competition and behavior in increasingly “networked markets” as well as for strategy development in these environments.

Chapter 10: Research Methods

Defining, Representing and Analysing Business Network Transformation

10.1 Introduction

The objective of this study is to develop a preliminary theory that clarifies the link between information technology applications and business network reconfiguration. In this study I develop two case studies of network transformation in the markets for tax preparation and health care services. These case studies provide rich examples of electronic integration strategies that enabled me to analyze the effects of these strategies on transformations in business network structures and processes. These markets were selected for this study due to the availability of documented examples of electronic integration, as well as convenient access to key industry managers.

The case study method was used to investigate electronic integration and business network transformation for three reasons. First, the case method is especially appropriate for the study of contemporary phenomena over which the researcher has little or no control. Second, the case study is well suited for exploratory research on topics which lack research consensus on theory or constructs. Third, the case method is cost effective for comparative analysis across multiple organizations and for addressing questions of how and why firms implement specific strategies in networks. ¹³

The research methods for case development and theory construction used in this study are discussed in this chapter. Specific attention is focused on issues

¹³Chapters 1 and 2, of Case Study Research by Yin [Yin, 1991 #19] provide useful guidelines for the appropriate use of the case study method.

of unit and level of analysis, constructs, data collection and case analysis for theory construction.

10.2 Units and Level of Analysis

The basic unit or item of analysis in this study is the business network. The business network is defined as the system of interdependent relations between the activities of a firm and those of other actors in its environment which influences each others strategies. Adapting Ansoff, the strategy of a firm is defined by the scope of activities undertaken by the firm to create products and services, as well as the markets served by the firm (Ansoff 1965).

Shifting the level of analysis to the level of the business network, seeks to bring the "environment back in to the analysis" (Marsden 1982) and understand the actions of firms in relation to their environment. All firms exist within a wider institutional environment that provide them with both resources for daily operations, as well as opportunities and threats that influence their long term survival. Analysis at this level seeks to understand how firms can shape the strategies, structure and relations between actors in their environment or inter-organizational field, and vice versa. Dill (1958) defines the organization's *task environment* as those institutions that have an immediate influence on a firm's operations. The task environment includes customers, suppliers, competitors, shareholders and government agencies. In addition, the wider *contextual environment* of social, political, technological and demographic factors influences the longer term activities of the firm. The nature of the environment can critically influence the selection

of strategies undertaken by the firm (Miller and Friesen 1980; Porter 1980).

Turbulent environments and the emerging effects of electronic integration make the business network an increasingly important unit of analysis. The business environment of the 1990s is characterized by increased turbulence, transformation and competition. Environments are changing rapidly due to innovations in products, markets, technology, as well as shifting firm, industry and national boundaries enabled by electronic integration (Drucker 1988; Johnston and Lawrence 1988, Antonelli, 1988 #111; Scott Morton 1991). These transformation in business networks give rise to new strategic management challenges. Management must select and position the firm to undertake specific activities within an increasingly complex business network, as well as select and construct suitable governance mechanisms both to coordinate and integrate the activities within the firm, as well as with the activities of its customers, suppliers and other organizations in the environment. As buffers between the environment and the firm are reduced (Rockart and Short 1989) managers must consider the effect of strategies on the business network, and manage activities at the level of the business network in order to ensure the continued growth and success of the firm. Thus the effective management of interdependence in business networks is critical to the firm, as the influence of the environment increases on the firm's strategies and its likelihood of success.

Despite the increasing importance of the business network as a unit of analysis, there are few frameworks and tools that support analysis and strategic planning at this level. In addition, current frameworks and tools are

unable to help decision makers manage the complexity of these emergent interdependent and networked environments. Shifting the level of analysis from the focal firm level to the level of the business network thus adds new complexity to strategic planning and research. This complexity arises from the numerous variables and organizations in a typical network that contribute to turbulence and uncertainties in the environment.

There are many challenges to constructing useful theories or frameworks to support strategy development in networks. First, it is necessary to develop systematic approaches for specifying and representing business networks that focus attention on the critical constructs that describe the salient features of the network. Second it is necessary to specify efficient means to collect data at the level of the network as well as techniques for data analysis. Third, it is necessary to catalogue, compare and analyze the behaviors of firms in multiple business networks in order to develop a theory of strategy in networked markets. The remainder of this chapter specifies the approach used in this study to develop a preliminary theory of the effects of electronic integration at the level of the business network. This required the specification of the roles-linkage model for business network representation.

10.3 The Roles-Linkage Model: Constructs and Business Network Representation

There are several possible alternative representation schemes for business networks. For example, the business network could be represented by showing which firms are interconnected to other firms in a network market. Such a representation would be very complex due the number of links between firms. Given limited human information processing and

interpretive capabilities, such a network representation would be too complex for meaningful strategy formulation. Complexity can be better managed by selecting an abstraction method that isolates and represents the business network in terms of a few key constructs, excluding unnecessary detail.

I propose that a roles-linkage model is a particularly useful abstraction for representation and analysis of business networks which is both analytically meaningful and managerially relevant. In the roles-linkage model the business network is represented in terms of two abstract constructs: *roles* and *linkages*. A roles-linkage model is a matrix, where the axes consist of roles and the cell values of the matrix are types of linkages that connect roles.

Roles are distinct value added activities undertaken by firms in the business network. Using the notion of technological separability as a basis for business segmentation (Gort 1962), roles can be defined as technologically separable value added activities in a business network. This definition of technology also includes specialized types of knowledge and equipment. Adapting Perrow (Perrow 1986), and Nelson and Winter (Nelson and Winter 1982), technology can be considered to be applied knowledge.

In any business network we can identify firms that provide value by undertaking various value adding activities or roles. For example, traditional insurance firms add value by combining money management with risk pooling and claims management services. Each of these activities requires different technologies, both in terms of knowledge and skills as well as equipment. Hence we can consider the traditional insurance firm as combining these roles into one organization.

A firm can may undertake many roles through vertical or horizontal integration: that is, the inclusion of roles within the legal boundaries of the firm. Alternatively, firms may create value in a business network by undertaking a single core role or by coordinating many different roles using various different modes of governance.

The concept of a role is especially useful for classifying individuals or organizations into common groups. The study of individual and social roles has been a central topic of sociology (Banton 1965; Nadel 1957). Sociologists and organization theorists have defined and delineated among roles in two principal ways: relational and non-relational (Nadel 1957). Relational roles only exist in relation to other roles (e.g father to son). Non-relational roles exist only because the actor engages in a common pattern of behaviours associated with the role (e.g. professor). Barley (1990) notes that such a typing of roles is not easy. Many roles have both relational and non-relational aspects. A professor may teach, but this depends on the relation with the student role. Thus a role can be considered to have both relational and non relational aspects.

Occupational roles are typically delineated on the basis of non-relational attributes of differentiated activities which require different skills, knowledge and task behaviours. In defining the concept of role in a business network I have extended the latter concept beyond individuals to organizations in an economic system. Like occupational roles, firms undertake a variety of different functions or value added activities in the business network. These can be delineated based on the skills and applied knowledge required for the tasks undertaken to accomplish the activity.

Indeed, defining roles in terms of distinct value added behavior and delineating them on the basis of technology is especially useful. It clarifies the link between technology and value adding activities of the firm, and permits systematic examination of how innovations or technological discontinuities alter the importance or exercising of roles in a business network.

Linkage refers to different ways of managing economic interdependence across value adding roles in a business network. Adapting and extending the models of governing economic exchange relations developed in the previous section of this dissertation, I specify six different classification types for linkages in a business network. These are: simple market exchange, standard linkage, specialized linkage, alliance, hierarchy and mandate. These forms of linkage reflect different models of coordinating and influencing economic relations between roles and are discussed below:

A simple market exchange refers to mechanisms typically used to manage infrequent transactions characterized by low levels of relation specific investments between a buyer and a seller. Typically the buyer and seller negotiate the price and exchange a standard or well specified good of relatively low value. The potential for opportunism is attenuated by the existence of alternative suppliers for similar or equivalent goods. Thus the market mode of governance is used to manage the exchange relation. In repeated transactions by actors across roles the terms of the exchange relation is typically redefined for each transaction between the parties.

A standard linkage refers to mechanisms typically used to manage frequent and routine transactions of relatively low value by actors across roles. Relationship specific investments are relatively low, but the relationship is more routinized than a simple market exchange and the terms of the agreement are generally not differentiated for each transaction between parties. The two parties therefore commit a low level of investment for administering repeated transactions. The existence of alternative suppliers and legal recourse attenuates opportunism. A standard linkage is exemplified by the use of standard contracts such as the agreements that govern repeated credit card transactions. Again a market mode of governance is typically used to govern these transactions.

A specialized linkage refers to mechanisms used to manage complex infrequent transactions that require significant a priori relationship specific investments or the acquisition of specialized information for valuation. Unique and specialized resources are committed to the transaction by at least one of the parties, as in the case of a transaction between a real estate holding company and a developer. To attenuate exchange risks, complex contingent contracts or specialized third party arbitration and intermediation structures are specified and implemented between the parties. In addition, complex coordination mechanisms may be deployed between parties to the exchange. These structures are unlikely to be modified frequently during the course of an exchange relation.

Customized linkages refer to mechanisms that are used to manage frequent complex and long-term transactions which require relation specific investments and adaptive behavior by parties across roles. This requires

frequent modification of the exchange relation in terms of the structures and processes implemented to coordinate and influence the relation. The prior analysis illustrated two principal variations exist for governing these types of exchange: alliances and hierarchies.

In an *alliance* or partnership both parties have committed specialized assets to the relationship and share risks. Authority is typically decentralized between the two parties for resource allocation and dispute resolution. To coordinate activities, the parties typically implement complex bilateral coordination mechanisms such as joint strategic and operational planning (Henderson 1990). These structures and processes are modified during the course of the exchange relation to respond to changing governance requirements.

In *ahierarchy* authority is centralized to coordinate and influence actors across roles, typically based on the ownership of the assets of production or the ownership of information assets. Complex and specialized routines and mechanisms are deployed in order to coordinate and influence activities between roles. Hence these types of linkage are appropriate for complex transactions that extend over long periods of time and are characterized by significant uncertainty.

While ownership provides the means for control, not all vertically or horizontally integrated firms manage actors in different roles through a hierarchy. Indeed actors in different roles within the same firm may be allowed significant autonomy over the design of their transactions. Hence hierarchy is not synonymous with vertical or horizontal integration.

The above typology provides a classification for economic exchange relations in a business network. As we go from simple market linkages to hierarchies the mechanisms used to coordinate and influence the activities between roles become increasingly complex. They reflect different management priorities and concerns for the governance of the relation.

In addition to the above models of coordinating and influencing direct economic exchanges between roles, there is another model of managing interdependence: the *mandate*. In a mandated linkage, there need not be a direct exchange of an economic good between parties. Instead, actors in one role can influence resource allocation by those in other roles through legal or professional authority, and the ability to make rules over the behavior of those in other roles. For example, physicians have traditionally had a strong mandate over the ability of pharmacists to sell prescription medicines. Mandates may be denoted as strong or weak.

Using the definition of roles and the typology of linkages, a business network can be represented as a visual matrix or grid that specifies a Roles-Linkage Model. The roles in the network form the grid axes, and the values of each cell represent the type of linkage between specific roles. The roles-linkages model is a pictorial representation of the dominant or critical modes of relations between roles in a business network. Like portfolio grids, it is a visual display of an adjacency matrix used to represent a business network.

As an illustrative example, the business network for tax preparation and related services can be defined in terms of six roles.

Table 10.1: Roles and Linkages in the Tax Preparation Market Place

	taxpayer /consumer s	return preparer	mail carrier	IRS	banker
taxpayer /consumer					
return preparer	\$ #				
mail carrier	\$ #				
IRS	MD	MD			
banker	\$ #				
retailer	\$	Δ			

key: \$ = simple exchange; # = standard linkage, Δ = specialized linkage, A = alliance, H = hierarchy, MD = mandate

The six value-adding roles, along with exchange and mandated linkages between these roles, comprise the basic elements for the traditional tax payment business network. The roles are the taxpayer, return preparer, mail carrier, banker, internal revenue service and retailer roles. The linkages between these roles define the business network.

Typically, individuals who assume the tax payer role file returns with the IRS. They may use a tax return preparer to prepare the return and a mail carrier such as the US Post Office or a value added service such as Federal Express to mail the return to the IRS. The IRS processes the return, and if a refund is owed the tax payer a check is mailed to the tax payer. The tax payer

as a consumer of services in this network can cash the check at a banking institution and save the money for later use, or alternatively use the money to purchase goods from a retailer. The typical linkages between these roles is illustrated in the matrix above. For example the link between the taxpayer and the IRS is best characterized as a mandate. The linkage between the taxpayer and other value adding roles are best characterized by market exchanges or standard contract.

10.3.1. Specifying Network Characteristics

Defining and representing the business network as an adjacency matrix of linkages between roles, enables the use of traditional network analysis indices to characterize the network. These include degree, centrality, distance and density indices (Knoke and Kuklinski 1982). The degree of a role refers to the number of other roles connected to a specific role. Centrality measures reflect the extent of involvement of a role in the entire network. The simplest index for role centrality, is the ratio of ties from a specific role to the total number ties between roles in the network. The network density refers to the number of linkages in the network as fraction of all possible ties in the network. The density is a measure of the overall degree of interconnectedness and the interdependence between roles in the network. These indices can be used to characterize network evolution and consider the evolving involvement and influence of specific roles on other roles in the network.

Traditional network analysis algorithms can also be used to create indices for *euclidean or the shortest path distances* in terms of number of distinct relationships, or intermediate roles between two distinct roles. This can be used to consider the means, as well as capacity of a role to influence actors

that occupy other roles. The index can also be used to systematically represent changes in network structure over time.

In the tax preparation business network we observe that the tax payer role is the most central role in the network with a centrality index of 5/7. The network density is 7/18, assuming the matrix is symmetrical. The effects of electronic integration on the roles, linkages and density, and centrality properties of the network will be considered in greater detail in later chapters.

In this thesis I propose that any business network can be represented using a roles-linkage model. The model can characterize the dominant or emerging structure of the business network and can be used to identify areas of transformation in the business network. It is also useful for representing the key value added roles of firm in relation to the business network, and the means by which the firm coordinates activities with other entities in the network. The model enables a systematic comparison of a firms strategy in a network with its competitors, or with the firm's own strategy over time. The potential uses of the roles-linkage model for representing and analyzing a business networks and firm strategies are considered in greater detail in later chapters.

10.4 Data Collection and Network Definition

Data collection for this study was done through interviews with industry managers, and complemented by extensive searches of archival material that documents examples of electronic integration. The data was used to construct descriptions of roles-linkage transformations in both the tax preparation and health care markets. The classification of roles and linkages were inferred from interview data, and review of company documents that characterized

specific businesses. The specification of roles was based on interviews with managers to identify the basic functional and value added activities in the network. The collection of roles is not necessarily exhaustive and it is based on identifying the strategies of existing firms and various products that they provide in the marketplace. The roles may not be specified to the finest level of granularity. Instead some roles are really complex roles - defined by a common aggregation of functions requiring a distinctive combination of technology and knowledge.

The classification of linkages between roles was also based on descriptions of inter-role relations in interviews with industry managers and from descriptions of inter-role relations in the trade press. Classification into the six types was specified through consideration of the following criteria:

- the extent of relation-specific investments between actors across roles,
- the adaptive and completeness of contracts across actors
- the distribution of authority for resource allocation and regulation of the exchange.

The classification rules are summarized in the decision tree below:

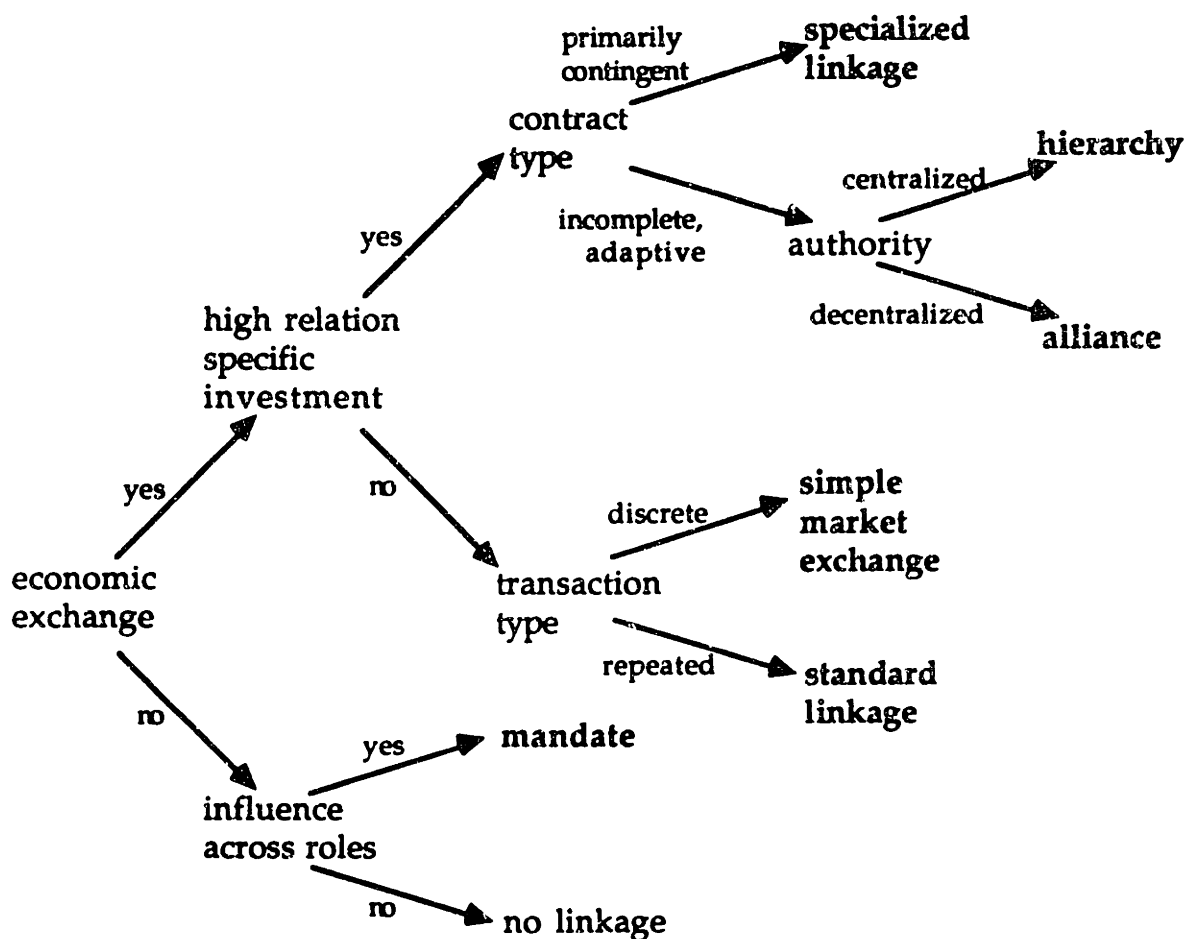


Figure 10.2: Specifying Linkage Types

Data was collected in both case settings to construct roles-linkage models of the market place both before and after significant electronic integration. In the tax preparation case there was a clear technological discontinuity in terms of the Internal Revenue Service electronic filing initiative. Hence roles-linkage models could be constructed to characterize the business network prior to and after the initiative. In the healthcare market there are numerous electronic integration initiatives and the network is highly unstable. Hence a roles-

linkage model was constructed to illustrate pre- and emerging managed care health care delivery environments.

10.5 Data Analysis and Theory Construction

The interviews and archival data were analyzed to identify significant applications of information technology and their emerging effects on roles and linkages. Analysis of these cases was used to build a preliminary theory and generalizable propositions on the motivation for and effects of electronic integration strategies at the level of the network.

Eisenhardt (1989) identifies four steps to the construction of theories from case study research. These are broadly categorized as the: analysing data, shaping hypotheses, enfolding literature and reaching closure. The analysis of data is at the core of the theory construction process from cases. Two general processes are the basis of data analysis for theory construction - within case analysis and cross case analysis. Within case analysis serves to reduce the volume of the case data, and typically involves a detailed write-up that describes the case. This is useful for generating preliminary hypotheses from a case. The cross case analysis serves to identify similarities and differences across cases and searches for patterns across cases. This forms the basis for constructing hypotheses and theories from the case studies.

This thesis employs both within case and cross case analysis for theory construction. The next three chapters provide a description and analysis of each case as well as a cross case analysis which is used to shape hypotheses and derive a preliminary theory on the effects of electronic integration. This preliminary theory is derived and shaped by constructing explanations for

transformations from analysis of archival and interview materials, by searching for evidence for “why” particular relationships and transformations occur, and by replication of logic across cases. This theory is initially stated as a series of propositions.

Next, these findings are compared to similar and conflicting theories. Specifically I examine these propositions in the context of three major streams of research - the structure conduct performance paradigm of industrial organization, transactions cost and political economy frameworks for explaining the adoption, deployment and effects of electronic integration. Eisenhardt suggests that comparing an emergent theory to the extant literature has two major benefits. First it can enhance the internal validity and generalizability of the emergent theory by providing further support for findings of case based research which typically rest on a limited number of cases. Second, comparison with extant theories and the literature provides the potential to break existing frames of reasoning and develop a new perspective. In this study the comparison to extant theory and literature is used to identify a distinctive perspective on the effects of electronic integration, that extends three complementary perspectives.

The final step in the theory construction and research process is that of closure, where further investment in case data collection or analysis gives diminishing returns.

10.6 Summary

This chapter outlined the process undertaken to execute this study. The roles-linkage model was specified to provide a conceptual schema for representing business networks that emphasizes the criticality of managing interdependence between firms and their environment. This model, by creating an abstract representation in terms of roles and linkages, focuses managerial and research attention on the salient constructs of interest in the network and provides a means of coping with informational and conceptual complexity of real business networks. As a structured representational tool it lets us analyze the effects of electronic integration strategies and other policies at the level of each individual role, while simultaneously considering comparative information and effects in relation to all other roles in the business network.

In the remainder of this thesis, the roles-linkage model is applied to two case studies of business network reconfiguration: the market place for tax preparation and health care services. These cases are analyzed to clarify how information technology applications transform specific roles and linkages in business networks, as well as why firms deploy electronic integration strategies. Within case and cross case analyses form the basis for constructing a preliminary theory of how electronic integration transforms networks. Comparison to extant literature clarifies and extends this preliminary theory and provides an analytic framework to support strategy development at the level of the business network.

Chapter 11:

Electronic Integration in the Marketplace for Tax Preparation: Description and Analysis

11.0 Introduction

In 1986 the Internal Revenue Service (IRS) began to implement a major technological initiative for electronic filing of individual taxpayer returns. This initiative was undertaken to reduce costs and improve the quality of service center processing of tax returns through automating paper handling tasks and reducing transcription errors by receiving data electronically.

Annually, service centers process about 100 million individual taxpayer returns and related forms. Service center processing also accounts for a third of the IRS's \$3 billion budget. In addition to reducing costs and errors, electronic filing was expected to reduce the time required for processing returns and issuing refunds from an average of eight weeks to three.

Annually, 75 million taxpayers receive a refund check worth \$900 on average.

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Electronic integrations in the market place for tax preparation was studied over the years 1987-1992. This market provided a useful setting for the study of electronic integration as the electronic link to tax preparers and other businesses for transmitting tax return information to the IRS, and electronic funds transfers of refunds, are two fairly simple electronic integrations

¹⁴ The evolution of the electronic filing initiative is discussed in greater detail in the *Sloan Management Review* Article: The Check's Not in the Mail Strategies for Electronic Integration, by N. Venkatraman and A. Kambil and in the MIT Teaching Cases: Electronic Filing (A) and (B) by Ajit Kambil

initiated by the IRS that have had a major impact on the market place for tax preparation and related services. In this case study we examine the effects of electronic integration on the marketplace for tax preparation.

11.1 The Market for Tax Preparation: Pre-Electronic Filing

The tax return preparation marketplace serves over 40 million tax payers every year. This market exists because tax payers find it difficult to prepare returns themselves due to the perceived complexity of tax laws and forms, and the perception that return preparers will identify larger tax deductions and refunds. Prior to electronic filing this market can be characterized by four distinct groups of tax preparers that vary in size and scope. This is illustrated in the diagram below.

Table 11-1: Strategic Groups in the Tax Preparation Market Place

Large Scale	H&R Block	Big "Six" Accounting Firms
Small Scale	Individual Preparers/ CPAs	Small Accounting Firms
	Narrow Scope	Broad Scope

Most of the market is served by large companies like H&R Block, with a narrow business scope in the market and large nationwide operations. Large preparers differentiate their services on the basis of location, brand image, and refund enhancement. Otherwise individuals use small local tax preparation firms or individual tax preparers and accountants. These firms also distinguish themselves on the basis of locality (in low population density areas) and service.

For more complex tax preparation services, as for proprietors of small businesses or executives of large firms with complex benefits, tax preparation can be provided by small boutique investment and accounting firms or large accounting firms which offer a broader scope of services and expertise. Thus firms differentiate themselves based on the skills and expertise available to customers.

Prior to the electronic filing initiative the market place was considered to be fairly mature. H&R Block was the dominant player in the market for the individual tax payer with a twenty percent market share. Most of the other individual returns were prepared by smaller tax preparation firms with a narrow business scope. The business network that characterized this part of the market can be specified by the relationships among six roles. These roles are: the taxpayer, return preparer, mail carrier, banking, Internal Revenue Service and retailer. The linkages among these roles define the business network.

Typically, individuals, who are both tax payers and consumers, file returns with the IRS. They may use a tax return preparation service to prepare the return and a mail carriage service such as the US Post Office or a value-added

service such as Federal Express to mail the return to the IRS. The IRS processes the return, and if a refund is due a check is mailed to the tax payer. The tax payer as a consumer of services in this network can cash the check at a banking institution and deposit the money for later use, or use the money to purchase goods from a retailer. In reality the banker is a complex role that combines check processing with savings.

	taxpayer /consumer s	return preparer	mail carrier	IRS	banker
taxpayer /consumer					
return preparer	\$ #				
mail carrier	\$ #				
IRS	MD	MD			
banker	\$ #				
retailer	\$	Δ			

key: \$ = simple exchange; # = standard linkage, Δ = specialized linkage, A = alliance, H = hierarchy, MD = mandate

Table 11.2 The Marketplace for Tax Preparation

The typical linkages between roles that defines the business network are illustrated in the matrix above. Appendix 1 provide process diagrams that illustrate how activities are organized across actors in different roles in the network. For example the link between the IRS and the tax return preparer and the tax payer is best characterized as a mandate. The IRS specifies the rules by which tax payers and tax preparers must prepare returns. The

linkages between the tax payer and other roles are best characterized as market exchanges or standard contract. Where tax payers have many alternatives, they may select service providers based on market prices. Alternatively, the exchange may be governed by a standard undifferentiated contract such as for mail service. The only specialized linkage is that between return preparers and retailers. Some retail firms permitted tax return preparers to operate on their premises during the tax filing season. This was done to encourage tax payers/consumers to visit stores during an otherwise slow retail season.¹⁵

Electronic filing as a technological discontinuity has led to major transformations in the business network. As a consequence of the electronic filing initiative, firms in the network have adopted a variety of electronic integration strategies that change their business, as well as their linkages with each other. The remainder of this section describes these strategies and considers their effects on the business network.

11.2 Electronic Filing and Transformations in the Tax Preparation Market

A variety of changes can be observed in the business network, ranging from the expansion of the number of relevant roles to new patterns of linkage between roles. These transformations arise from the application of information technology to provide new products and services as well as manage linkages between roles in new ways. The emergent business network is illustrated below in Figure 11.3.

The various transitions can be described and analyzed in terms of the addition of transformation of roles and linkages.

¹⁵Interview with Tom Bloch. An example is the relationship between Sears and H&R Block.

	tax payer	ret. preparer	mail	IRS	bank	retailer	e-filer	Net provider	software	cons. credit	tax plan	Stock Broker
tax payr												
return prep	\$, #, Δ											
mail	\$											
IRS	MD	MD										
bank	\$#											
retail	\$	A										
e-filer	\$	H, A, Δ		MD	#	H, A						
Net provider		A, Δ		MD	#	#	#,A					
software	\$	H, A, Δ		MD		#	#, H	#				
cons. credit	#, Δ	A, Δ			H,A	H, A		#				
tax plan	Δ	H			A, H	A		#	#,Δ			
Stock Broker	,\$#	Δ,A			A, Δ			#		A	H,A	

key: \$ = simple exchange; # = standard linkage, Δ = specialized linkage, A = alliance, H = hierarchy, MD = mandate

Figure 11.3:

The Emerging Business Network for Tax Preparation and Related Services

11.2.1 The Addition of New Roles: Expanding the Business Network

As a consequence of electronic filing seven new roles gain strategic relevance in the traditional tax preparation business network. Firms in these new roles can influence the strategic choices of firms in the earlier network. The six new roles are : electronic filer, communications network provider, software vendor, consumer credit provider, tax planner, and investment/stock broker. The electronic filer receives the tax return from a customer in paper or electronic form, and transmits it electronically to the IRS. The electronic network provider provides a value-added network for data transmission. The software vendor provides tax preparation and/or communications software. These three roles are required to implement the simplest electronic filing service in the business network, and become important as a direct consequence of the IRS's electronic filing strategy initiative. While IRS studies showed an increase in computerized tax preparation even before the electronic filing initiative, investment in information technology solely for tax preparation was limited due to the seasonal nature of tax preparation.

Other new roles in the network provide financial and information services. These are the consumer credit role which provides loans to tax payers. The tax planner provides longer term financial advice to reduce future tax liabilities and the investment broker sells securities and bonds to the tax payer. The information broker sells information of value to others in the network. These new roles provide new sources of value in the network. The linkage of new roles with existing roles provide new products and services to

the tax payer and others in the network. This expansion of roles and linkages transforms the boundaries between markets.

11.2.2 New Linkages: Redesigning the Business Network

New Products and Services

The new roles in the network can be linked to produce a variety of new products and services in the tax preparation business network. For example, combining the electronic filer, communications network provider, and software provider roles provides a new product in the market, such as H&R Block's Rapid Refund program. This product promises tax payers a quicker refund than if they filed on paper and is generally provided for a \$10 to \$40 premium fee. These three roles can be linked with the tax payer role and return preparer roles in a variety of ways. For example, larger tax preparers may bundle "electronic filing" with the tax preparation product in-house. Individual tax payers or smaller return preparers may use a specialized electronic filer business such as Instatax or Nelco Inc. (Bartolik 1990), which provide electronic filing through specialized contract or partnership with different return preparers, software vendors and communication network providers.

The communications network provider role is generally contracted out through as standard contract, or as a specialized contract to a third party value-added network service. GE Information Services and CompuServe both provide value added network services for tax filing. Indeed, these

organizations are beginning to offer tax preparation and electronic filing online to their individual subscribers (Meadows 1990; Ojala 1989)¹⁶.

Software for tax preparation and electronic filing are also generally contracted out to third party vendors as there are economies of scale associated with the production and use of software.

Another new product in the tax preparation business network is the instant refund, or refund anticipation loan. Here the tax preparer and credit provider link to implement electronic filing in combination with a loan against the anticipated IRS refund. When the electronic return is transmitted, it is checked by the IRS to verify accuracy. This verification enables the credit provider to issue a loan or instant credit against the security of the anticipated IRS refund. The repayment of the loan can also be secured as the electronic return can mandate the IRS to deposit the refund directly into the credit provider's account.

¹⁶For example, tax preparers can take the electronic returns and upload them to CompuServe, which reformats the information for the IRS computers and uploads the data in the IRS-approved format. CompuServe also has the computer resources to do electronic filing of tax returns for its individual subscribers, but for now this is available only through its parent company's H&R Block stores. CompuServe's 550,000 subscribers may be offered the service in future years.

General Electric, in partnership with a California company called ELF is making electronic filing available to the 170,000 plus subscribers of GE's on-line service, GENie. GENie puts facsimile IRS forms right on the subscriber's screen. The tax-return-preparation program is accessed for a charge to the tax payer's credit card, filled in off-line at leisure, and then fed back to the on-line program for calculation. For an additional charge, the return is filed electronically through GENie. The refund is mailed to or deposited directly to the tax payer's bank account. Other services provided by ELF include refund advances.

A variety of organizations have entered the tax filing and preparation market to extend their core businesses and differentiate their products and services. For example, Dollar Dry Dock Bank of New York offers a three to five day no interest refund advance in combination with electronic filing service to customers for a fee of \$45. It also offers non-bank customers a new bank account for using this service, thereby increasing the number of bank clients. For an extra \$27 to \$108 or more, depending on the complexity of tax returns, the bank also provides a tax preparation service (Dollar Dry Dock Bank 1989). The instant refund is one extension of the bank's traditional core business.

Both the rapid refund and instant refund products focus on leveraging the features of the technology to speed up returns processing or to control monetary resources and information flows. Hence electronic integration leads to new products and services through the creation and linkage of new roles in the business network. These new products and services provide growth opportunities for firms in the business network.

Differentiation

In addition to enabling the provision of new products and services, existing firms in the network can implement electronic integration to link across roles and differentiate their current products and services. As the cost of computerized tax preparation falls due to decreasing hardware and software cost, and electronic filing leads to greater use of computers for tax preparation, it is reasonable to expect the value-added or margins from this service to fall. One electronic integration that permits tax preparers to differentiate their products is to combine the tax planning and return preparation roles. Specifically, data from large numbers of taxpayers can be analyzed to develop

benchmarks and identify ways of reducing tax liabilities in future years. Using this information, the tax preparer can advise the tax payer on how to reduce future liabilities. This strategy systematically exploits the information resources available to tax preparers as a byproduct of their normal activities.

Information Integration across Markets

Electronic integration also enables firms to extend their influence into other markets. Firms can link the tax preparer, planner, and investment broker roles to influence demand in previously separate markets. For example, tax information provided by a tax payer to a return preparer, allows a tax planner to create customized investment portfolios designed to reduce future tax liabilities. By linking roles, an investment broker can then sell these securities to the tax payer. For example, American Express's IDS unit coordinates across these three roles within the American Express organization. This strategy enables Amex to leverage its position in one market to influence demand and roles in a related market. Electronic integration focuses on leveraging information assets acquired in one market to differentiate products and services in a previously separate market.

Another example of coordinated multimarket competition is illustrated by retailers who also provide consumer credit through instant refund products linked to store cards. Specifically, a retailer in partnership with the a return preparer and the store credit card operation can provide discounts on tax preparation and filing, or store discounts if the refund is directed to the store credit card. Such initiatives transform and create incentives for tax payers to purchase products from a specific retailer. These emerging linkages also lead to more multiplex business ties between retail organizations and tax

preparers, transforming the relationship from a specialized contract to a partnership.

11.2.3. Transformation of Roles

As electronic integration strategies are undertaken in a business network, the value of a role to the rest of the network can be diminished. For example, the electronic filer and communications network provider roles increasingly substitute for traditional mail service.

Second, information technology applications can transform the competitive advantage of actors in specific roles. As return preparation becomes increasingly computerized, tax preparation firms which did not previously invest in information technology must increasingly automate the tax preparation process and diversify into related roles to compete.

Third, the technology can be used to provide new sources of advantage through differentiation. Artificial intelligence systems can be used to distribute expertise across the organization, improving the ability of large firms to provide more value added services at lower cost.

11.2.4 Transformation of Prior Linkages

In addition to creating new roles and relations in the business network, electronic integration strategies can be applied to transform prior relations in the network. For example implementing customer data bases can be used to improve service and change the linkage between the firm and its customer. Specifically, by maintaining files from previous years, tax preparers can provide a convenient record keeping service to the customer, and improve client interaction by reducing the time required to acquire standard

information. By using computers for return preparation and tax planning, traditional return preparers are trying to change the relationship with their customers from a market exchange to a more standard and repeated linkage. In essence, by permitting the storage of customer-specific information and prior records, the customer and tax preparer form an "information bond". The information bond is a specialized "information investment" in a specific relationship that is of little value outside of the relationship. This investment provides the tax payer with the incentive to continue using the same preparer.

Another means of transforming the relationship between roles is through the use of information technology is to transform a linkage from a discrete exchange to part of an ongoing relationship. For example, H&R Block links its expertise as a tax preparer and planner, with electronic communications through its CompuServe subsidiary. Subscribers of CompuServe can get immediately-useful tax tips, tax advice, tax news, and a list of important income tax dates by typing "Go HRB" on the network. This linkage encourages CompuServe users to use Block's tax preparation services, and enables the tax preparer segment of the company to maintain an ongoing linkage with its customers. CompuServe subscribers have a standard contract with the company.

11.2.5 Changes in Centrality and Density

Adapting the notion of centrality from traditional network analysis, we note that the tax payor role is the central role in the pre-electronic filing network with a centrality index of 5/7. The greater the centrality of a role, the greater the involvement of the role with all other roles in the network. The tax

payer role is most central to the network, as it is tied to most other roles. The network is generally sparse with a density of 7/18.

As the number of roles and linkages increase in the network to centrality indices for roles are altered. In the emerging network we observe a new set of roles with high centrality. These include the electronic filer roles with a centrality index 7/39 which is close in comparison to new tax payer centrality of 10/39. The network density of the new model is 39/72 as compared to 7/72 which represents the prior density of links in comparison to the current network.

The shifts in centrality and density suggest that managers must coordinate over more roles. As electronic integrations occur in the market, the density of more complex linkages increases.

11.3 Analysis and Management Implications

The electronic filing case study illustrates a variety of different transitions in the market place for tax preparation.

First the case study highlights to dimensions of an electronic integration strategy: technology or information leverage. Technology leverage takes advantage of performance to cost improvements of information processing (e.g storage, input/output, communications or processing) to improve a product or provide a differentiated service. The example here being the rapid refund product which took advantage of the speed of electronic filing.

Information leverage takes advantage of the information resources to create new sources of value. This is illustrated by efforts at benchmarking or

integration and leverage of information resources across markets to sell securities by American Express.

Second the case study illustrated a variety of different business network transitions. These include the emergence of new value added roles and linkage of strategic relevance in the network, as well as the transformation of existing roles and linkages in the network. These new roles and linkages defined new products and services in the market place as well as a shift in emphasis toward new roles such as the electronic filer role in the market place. As firms change business scope and the competitive field expands, new firms enter and can assume important roles in the market (e.g software vendors such as Instatax or communications vendors such as GE Information Services). In addition there is an increased shift from market exchanges to more complex linkages such as specialized contract or standard contract. Firms seek to shift linkage from a discrete market transaction to a specialized linkage by investing unique information assets about the customer, or to repeated transaction by providing related informational services as exemplified by the provision of tax advice on CompuServe.

Third the case illustrated fundamental shifts in the strategy of actors in the network. Electronic integration enables actors in the network to differentiate products and services through technology and information leverage (e.g instant refund product). Firms can also use information technology to coordinate multi-market strategies to take advantage of complementary products or product externalities. For example there is an increased shift to bundle multiple roles to provide complex products that transcend traditional market boundaries (e.g refund anticipation loans in the form of store credits). This represents a shift from simple single market competition to coordinated

multimarket competition where information technology plays a critical role in the coordination and control of product delivery across multiple markets.

As information technology is widely adopted in the market there is an increased shift to more knowledge intensive forms of competition. As information technology is used to automate traditionally routine tasks, value added shifts to the capacity of firms to analyze information, derive knowledge and insight and use this as a basis for competition. This is exemplified by the benchmarking activities for tax planning and increased information processing to provide customers with specialized services (e.g targeted marketing of bonds that reduce future tax liabilities).

Summary

To summarize, the electronic filing case illustrated four types of transformation in a business network. First, electronic integration leads to the emergence of new roles in the network. These new roles create new sources of value in the business network. Second, the emergence of new roles results in new linkages in the business network to provide new products and service, and to influence competition across markets. Third, electronic integration changes the importance and value of specific roles in the market place. For example, from the network diagram and centrality index it is clear that the new electronic filer role is the critical role that is the basis for most product and services in the market. As, the value of the return preparation is diminished due to increased automation, tax preparer firms are diversifying into tax planning to differentiate products and services. Fourth, the case illustrates the transformation of existing linkage in the marketplace. As

information and technology become specialized investments in relations there is a shift from market exchange to more complex forms of managing interdependence.

This case study has provided a description of electronic integration strategies, and transformations in the tax preparation market place. The next chapter develops a description of electronic integration in the market place for health care delivery.

Chapter 12

Electronic Integration in the Marketplace for Healthcare Services: Description and Analysis

12. Introduction

There is a national consensus among major forces in business, government, unions and consumers that health care is a major national problem. This crisis in health care is one of providing quality medical care, while containing health care costs and providing the public with adequate access to care.

In this case study and analysis I examine how electronic integrations and the various applications of information technology are shaping the structure and functioning of the health care business network. In contrast to the tax preparation case study, there isn't a single application of information technology that is transforming the network. Instead a number of different applications, as well as other factors and different policy choices and actions by actors in the network, shape the emerging structure of the business network.

The health care market place was chosen for study due to convenient access to decision makers in hospitals, insurers and managed care providers. In addition there is substantial archival material on different applications of information technology in the industry. The description and analysis of transformations in the business network was constructed through extensive interviews with industry managers and analysis of company materials and the trade press.

12.1 The Health Care Crisis

Today the United States spends more per capita on health care than any other industrialized nation. However, it does not rank first in terms of quality or access to care. The inflation rate of health care costs is nearly twice that of the national inflation rate, and health care expenditures have grown at a 12.3% compound annual rate over the past 20 years, as compared with a 8.8% rate for nominal gross national product (GNP) (Saftlas 1990). In 1990, total health care costs of \$671 billion accounted for 12.3 percent of GNP. By the year 2000, the Department of Health and Human Services projects national health care expenditures to exceed \$ 1.6 trillion , or 16.4 percent of the GNP (Fisher 1991). As the private sector accounts for 57% of health care expenditures (Hofmann 1991), inflation in health care employee benefits costs are reducing the profitability and ability of U.S companies to compete in the world economy.

As employers restrict benefits to contain 20% to 30% annual increases in health care benefit costs, the number of uninsured has increased to over thirty seven million Americans. In addition there are many others without adequate coverage, especially for catastrophic illness. The large numbers of uninsured, and poor access to medical care also adversely affects the quality of care, and increases societal costs, while reducing the "well being" of individuals and the productivity of the nation.

The factors underlying this crisis in health care and the escalation in health care costs are well known. These include the consumer's insistence on quality health care regardless of costs; the rapidly increasing population of elderly who are disproportionately large users of health care; the emergence of expensive and catastrophic ills such as AIDS, and increasingly sophisticated

medical technology which produces new high priced diagnostic tests, therapeutic equipment and medicines. In addition various policy choices lead to the inefficient administration, allocation and utilization of medical resources. As the consumers of health care services do not generally pay for them directly, and given their concern for quality, free market forces that drive down prices in other markets work differently in the health care market. In addition, fee for service reimbursement and for profit health care provide incentives to expand rather than restrain the use of expensive diagnostic and therapeutic treatments. This also results in over-investment in cardiac centers and other expensive technologies that are covered by insurance, and disinvestment in hospital trauma centers which attract uninsured patients, thereby further reducing access to quality care (Saftlas 1990).

The administration of the health care system is expensive as well as information and paper intensive. With nearly 10 million daily patient visits, and over 1500 hundred different insurance programs, each with their own claims processing, marketing and administrative staff, administration and claims processing is both expensive and inefficient. Indeed, 24 cents of every health care dollar is spent on administration as compared to 11 cents per dollar in Canada and other single payer systems [New England Journal of Medicine, 1991].

As employers, insurance firms, and health care providers try to contain rising costs, the traditional health care market is undergoing a significant transformation to "a managed care environment". While it is not feasible to control demographic, disease and technological changes as cost factors, managed care initiatives try to contain costs by careful administration and

allocation of health care services and by altering incentives for over-utilization and other inefficiencies in the market. Information technology applications are playing an important and critical role in this transition.

In this case study the roles-linkage model is used to characterize transformations in the health care business network and to investigate the emerging effects of electronic integration on this business network.

Specifically I model and analyze the structure and functioning of the business networks prior to and during the transition to a managed care environment.

In this analysis I examine the role and application of information technology as well as other factors that shape the structure of these networks.

12.2 The Health Care Business Network Prior to Managed Care: The Third Party Payor - Indemnity Insurance Model

The conventional health plan and delivery system is often referred to as the commercial indemnity insurance or third party insurance model. Under this model a commercial insurance carrier, or Blue Cross/Blue Shield will sell insurance to an employer who provides employees with health care benefits. The majority of health insurance is offered through private company, union or government sponsored health plans. The employee or patient can purchase health care from any physician who honors the plan, and the insurance firm will reimburse the physician on a fee for service basis (at the usual customary rate) or a cost-plus reimbursement basis. The roles-linkage representation of this traditional health care business network with traditional indemnity insurance is given below. This network can be represented by linkage between thirteen critical aggregate roles:

Figure 12.1 Dominant Roles and Linkages

	purch	cons	phys	hosp	pharm	distrib	lab	benefits design	risk mgt	claim admin	enroll	payment mgt	money mgt
purchaser													
consumer	H												
physician		\$ #											
hospital		Δ	# Δ										
pharmacy		\$	M	H									
distributor				#	#								
laboratory		\$ Δ	A M	H A		#							
benefits design	Δ H												
risk management								H					
claims administration	#		#	#	#		#	H #	H				
enrollment	Δ	# Δ						H	H	H			
payment management			#	#	#		#	H	H	H	H		
money management								H	H	H	H	H	

Key to symbols:

- \$ simple exchange
- # standard linkage
- Δ specialized linkage
- A alliance
- H hierarchy
- M mandate

The *purchaser* buys health care services. The purchaser role may be taken by an employee, employer, or the government¹⁷. Today the private sector accounts for 57% of all health care payments and purchases. The remainder is funded through various government programs, primarily Medicare for the elderly, and Medicaid for the poor. The medical services *consumer* is the patient. In a third party payment system often the consumer of health care is different from the purchaser of health care benefits. The consequences of this difference are considered later in this case study. The *care provider* or *physician* role provides medical services to the consumer. This role is primarily occupied by a medical doctor who diagnoses illness, prescribe treatments, and refers patient for further treatment to other physicians as care providers or hospitals¹⁸. The physicians may be independent practitioners or part of other organizations. *Hospital services* or *hospitals* refer to the administration and provision of a specialized workshop to physicians to ply their trade. This includes facilities, equipment, infrastructure, and personnel to assist the care provider in patient care. Hospital organizations are normally reimbursed on a fee for service basis. The *pharmacy* role provides care providers, patients and hospitals with medicines as well as information on the use prescription and non-prescription drugs. *Distributors* provide hospitals, physicians' clinics and pharmacies with medical supplies. *Laboratories* provide specialized services such as the conduct of medical tests and the analysis of medical samples to provide physicians' with specialized

¹⁷In 1985, 97% of all private companies reported some form of health insurance payment. U.S Chamber of Commerce, Washington D.C.

¹⁸ Although there are other care providers including nurse practitioners, midwives etc, we do not consider them in this paper.

diagnostic information. These roles combine to purchase, consume and provide medical services.

The relations between providers and consumers of health care are generally intermediated by seven roles. These roles typically comprise of benefits consultants and insurance firms.

Benefits design refers to the role of designing employee health care benefits plans. This can be undertaken by benefits managers within the firm, or through hiring specialized consultants such as Towers Perrin Foster and Constance (TPFC). Five other critical roles in the business network are generally integrated into the insurance firm as illustrated by the roles-linkage diagram above. These are: risk management, claims administration, enrollment, payment and money management. The *risk management* role refers to the assessment of actuarial risk, and its diversification through pooling risk across a large number of patients. This serves to reduce the costs incurred by any single patient, and the risk manager receives a fee for bearing any residual risk. *Claims administration* includes the collection, and processing of medical claims from care providers and hospitals for services rendered. This includes adjudication of claims when disputed as well as identification and nonpayment of fraudulent claims. *Enrollment* refers to the role of designing specific plan packages, enrolling different purchasers and their employees into the system, and maintaining and administering their records. *Payments management* refers to the process of coordinating the transfer of payments from the insurer to providers. *Money management* refers to the investment of funds paid as insurance premiums at the time of enrollment. Effective investment of funds can be a source of profit and competitive advantage to the insurance firm. In the traditional health care

network the insurance firm combined these five roles through a hierarchy. This is illustrated in the roles linkage diagram given earlier. Relationships between roles and processes in the pre-managed and managed care health care networks are also illustrated in Appendix 1.

However, the roles linkage model clarifies the critical roles, structure and linkages in the pre-managed care business network. Most of the relations in this network are standard contracts. Typically care providers are reimbursed based on usual and customary charges specified by the insurance companies.

The centrality indices identify consumers, and care providers as the critical roles in the business network. Considering the nature of linkages between care providers and other roles we can see that care providers have a strong mandate over the allocation of resources by most other provider roles. Indeed studies show that while physicians fees account for 20% of health care costs, they have a strong mandate over the allocation of 70% of health care expenditures.

12.2.2 Analysis of Structure and Processes in the Pre-Managed Care Network

The pre-managed care health care system does not efficiently allocate resources and has led to the health care crisis described earlier with rapid inflation, and poor access to care for many people. Allocative inefficiencies arise due to externalities as well as policy choices that promote incentives against efficiency. In addition Williamson (1975) identifies *uncertainty* and *opportunism* as the critical sources of market failure and allocative inefficiency by giving rise to agency or transaction costs.

The traditional indemnity model of payment and delivery of health care provides various examples of incentive misalignments and agency problems that give rise to market failure. This traditional model does not provide consumers or providers with incentives for cost control. A problem with the third party payment arrangement is that the patient has imperfect information and does not have to bear the full cost of health service provision. Hence, patients are likely to over-consume health care services. Similarly, the fee for service payment mechanism encourages physicians to increase earnings through over-utilization of services by prescribing various tests and unnecessary therapeutic procedures. They also have little incentive to be efficient in their use of services.

Agency problems arise due to the difficulty of monitoring and managing agents in this large network. It is especially difficult to monitor and control physician behaviors due to high task variability in their work. It is also difficult to evaluate the value of physician services and identify if they are engaging in opportunistic behavior. For example, one out of eight physicians have equity in labs that serve their patients. Care providers can prescribe unnecessary tests and guide patients to use labs in which the care provider has equity, thereby increasing care provider, and lab profits at the expense of the consumers and purchasers.

Market failure also occurs due to externalities associated with adverse selection. In a competitive market place commercial insurance firms adopted the practice of experience rating, which charged the employer a premium based on the expected health expenditure of the specific group within the company. Such group health plans selected generally healthy employees for

insurance. In contrast Blue Cross/Blue Shield offered community rating which based premiums based on everyone in a specific geographic area. However, Blue Cross/Blue Shield was forced to adopt experience rating to avoid losing healthy low cost groups from their insurance pool. As more and more insurance firms adopt experience rating and undertake *adverse selection of customers* (Akerlof 1970), small firms who may have a single employee in a high risk category find they cannot afford insurance premiums. This is forcing many small firms to deny insurance benefits to all of their employees or jobs to specific employees, thereby increasing the number of uninsured Americans.

Finally the competitive price system for resource allocation is distorted by the care providers' professional dominance and mandate over resource allocation on a non-price sensitive basis. Care providers in a third party payor system have little incentives to select efficient ways to treat patients. They have a strong mandate over resource allocation by hospitals, pharmacies and other actors in the treatment of patients.

The structure of the business network where the physician plays a dominant care provider role is not an accident. The physician's influence over resource allocation in the business network has evolved substantially over the last century, as a consequence of technological changes and voluntaristic actions by physicians to form a professional guild. These technological changes and actions by physicians have shaped the structure of the network, its payment processes and served to maintain the influence of the physician role in the business network.

Early medicine was more a craft than a science. Before 1900, medical services were typically provided at the home of the patient, and many services such as the delivery of children were provided by mid-wives or experienced amateurs. The physicians primary tools were the contents of his little black bag, experience and limited training. This "horse-and-buggy" delivery of health care by the physician on a fee-for-service basis to the home of the patient is in sharp contrast to modern pre-managed health care business network, where the physician practices specialized medicine in hospital settings with advanced technology resources for diagnosis and therapy.

Technological innovation and scientific discoveries in medicine led to an explosion in medical knowledge. This in turn led to the specialization of the medical practice and the emergence of medical schools. Specialized knowledge and professional training and credentials, enabled physicians to gain more professional dominance, and autonomy over their work. Friedson (1970) shows that dominance arose from the specialized nature of the work which is not easily monitored; the ability to control the work of others through ownership or critical positions in bureaucratic structures; cultural beliefs of treating doctors as healers and the ability of the profession to parlay complex knowledge into cultural, legal and institutional authority. The latter has resulted in the physicians' strong influence over other roles in the network, such as laboratories, hospitals, pharmacies and other roles.

Professional dominance has provided physicians with significant latitude in the exercise of their jobs. Most physicians work as independent practitioners, in contrast to being a salaried employee of a firm. They also set the prices for services, as well as recommended diagnostic and therapeutic procedures with

little review for quality or commitment to cost containment. In this direct fee for service model the physician as the primary care provider dominates the consumer-care provider relationship.

Third party payors and indemnity insurance primarily emerged after World War II. Major social changes occurred, resulting in increased collective bargaining, and tax incentives led to expanded employer provided health insurance. Initially the concept of health insurance was opposed by the American Medical Association. In the 1920s and 1930s physicians had used their professional dominance to resist institutional buyers who sought to buy medical services on a capitated basis or provide services through salaried company physicians. Using their control over medical school curricula and state and county medical licensing boards, physician trade organizations urged their members not to bid for "contract medicine" with the threat of expulsion from the profession through the loss of licences.

However, the increasing cost of medicine and social change led to the AMA supporting employer provided health insurance. These benefits initially covered care provided at hospitals but have expanded over time to more comprehensive coverage of visits at the physician's office and prescription drugs. The emergence of third party payor systems with insurance firms and employers as payers resulted in an increasingly complex business network. The insurance firms added many valuable roles to the network, including risk management to pool risks over a large population and bear the risk of any individual requiring expensive medical care. However, given physicians' professional dominance, the third party payor indemnity insurance model

still retained fee-for-service as the dominant form of payment for medical care to providers.

The power of the medical profession, arising from its specialized knowledge, and collective structures, thereby retained a payment mechanism and a system with little competition and incentives for cost containment (Light and Levine 1989).

12.2.3 The Role of Information Technology in the Pre-Managed Care Network

While information technology was extensively used in the health care network, it was not primarily used as a strategic asset shaping the business scope or the business governance choices of actors in the network.

Information technology was primarily used for transactions processing and reporting, supporting record keeping, claims processing and payment activities in insurance firms, and record keeping and operational activities such as purchasing, and inventory management in hospitals. Indeed insurance firms were among the lead adopters of early mainframe computers. However, as these applications were primarily transactions processing systems their impacts were contained within the boundaries of the firm. Other applications of the technology included its use for research and scientific computing applications in medicine.

Despite the extensive use of computers within insurance firms and hospitals, the lack of standards for electronic patient records or claims resulted in a very paper intensive system for coordinating processes across organizations.

12.3 The Emerging Managed Health Care Business Network

The health care cost crisis is motivating the principal stakeholders in the health care market to adopt new strategies for governing the health care delivery system. These initiatives by health care purchasers, insurers and care providers are transforming the prior business network into a "managed care environment". As the "management of care" is primarily an information processing activity, information and information technology play an increasingly strategic role in this environment, impacting the business scope and the management of interdependence between organizations.

Under the different managed care initiatives, purchasers and providers take a variety of steps to monitor, control and "manage" health care spending. Specifically they redesign linkages between roles, and alter individual and organizational incentives to influence the behaviors of consumers, care providers, hospitals and other health care provider roles. These steps are taken in order to reduce losses from lax governance, over-utilization and other sources of market failure discussed earlier.

A variety of new roles and linkages become important in the emerging managed care market place. Eight critical new roles emerge in the network as strategically relevant and altering the business scope and management of interdependence between actors in the network. These are: utilization management, information brokerage, provider network management, credit providers, shared services providers, network providers, software and hardware providers. These roles are defined and the emerging business network is illustrated below.

Figure 12.2 Emergent Linkages

	purch	cons	phys	hoosp	pharm	distrb	lab	benefits design	risk mgt	claims admin	enroll	paymt ngt	money mgt	utiliz mgt	info broking	provider network mgt	credit provider	admin service provider	network provider	software	hardware
purchaser	H																				
consumer		A Δ																			
care provider/physician																					
hospital	Δ	Δ	A																		
pharmacy	Δ	A Δ	M	H A																	
distributor				A	A Δ																
laboratory		\$ Δ	M	H A	A #																
benefits design	H Δ																				
risk management	H Δ							H A													
claims administration	#	#	#	#	#	#	#	H A #	H Δ												
enrollment	H	#						H A	H Δ	H A											
payment management	H							A #	H Δ	H A	H Δ										
money management	H							H A	H Δ	H A	H Δ										
utilization management	Δ		M	M H M Δ				H A	H Δ	A Δ	H										
information brokerage	Δ	\$		\$	H			\$ H		H	A Δ		\$ #	H A							
provider network management	H	Δ	A H H Δ	A Δ	A Δ			H A	H Δ	H Δ	H A	H A	H Δ	H Δ	A Δ	H A					
credit provider			A	A	A			H Δ		H Δ	A #	A #			Δ	H A					
shared admin. services provider			#	H											Δ						
network provider			#	H #														H #			
software provider		\$	\$	Δ				\$	\$	H Δ	A Δ	A Δ		H Δ	H A	Δ		# Δ	H Δ		
hardware provider		\$	\$	Δ				\$	\$	\$ Δ	\$	\$		\$	\$	\$		# #	H Δ	H A	

Key to symbols:
 \$ simple exchange
 # standard linkage
 Δ specialized linkage
 A alliance
 H hierarchy
 M mandate

Utilization Management - refers to the role and processes associated with monitoring and approving specific treatments. Utilization management includes pre-hospitalization review, discharge planning, and post-treatment review. Using information derived from medical practices and claims outcome analysis, standards for medical utilization are developed by utilization reviewers. Using this information, a nurse practitioner at a hospital or at a different site does a preliminary review of the case. If there are problems the case is referred to a doctor at a central location. A care provider must get approval from the utilization reviewer for particular treatments, or run the risk of not getting paid by the insurer. In this model the authority of the payor and insurer is increased through the implementation of the utilization review role. *Information brokerage* refers to the role of acquiring, storing, analyzing and reselling information. Typically this information is used to support utilization review and other managed care roles. For example information brokers provide data bases on physician training and practices that are useful to those seeking to employ physicians. Different information brokerage strategies are considered in greater detail later in this chapter. *Provider network management* - refers to the processes of constructing and managing a network of care providers. This role is central to most managed care schemes as illustrated in the business network diagram. *Credit providers* provide consumer credit for the purchase of health care services and *shared administrative service providers* play the role of providing administrative services in the business network.

The above roles rely on an information technology infrastructure that is provided by the following roles in the network. *Network providers* - provide value added networks as an information infrastructure to connect actors that

occupy different roles in the business network. This role is responsible for maintaining information standards. *Software providers* develop software for actors in different roles, and *hardware providers* provide computer and communications hardware to different roles.

As the delivery of health care shifts toward managed care, the above roles combine with prior roles to define three general models of managed care: indemnity plans with utilization management, preferred provider organizations, and health maintenance organizations. These models vary in terms of incentives, modes of linkage and degree of influence of actors over the behaviors of different stakeholders in the health delivery system. These models are considered below.

12.3.1. Indemnity with Utilization Management

An indemnity plan with utilization management is the simplest form of managed care, and is not significantly different from the traditional health care model. Under utilization management, a nurse practitioner at a hospital or elsewhere does a preliminary review of each case admitted or referred to a hospital or a laboratory. The case is evaluated in term of standard utilization patterns of medical services for different ills and conditions. If the treatment pattern varies significantly from the traditional pattern the case is referred to a physician for review. Insurers and payers require care providers to have authorization from utilization reviewers for particular treatments. Otherwise the care provider runs the risk of not getting paid by the insurer.

To implement this model the utilization management and information brokerage roles are required in the network. Typically large insurance firms combine these roles with traditional insurance roles within the boundaries of

the firm through hierarchy. Smaller insurers can contract with specialized utilization management firms and information brokers. In this model the primary uses of information technology are to coordinate the utilization management process, and to collect, store, and process large amounts of claims data to identify utilization patterns. Utilization management transforms the business network by primarily changing the nature of linkages between the payors and purchasers of health care services and providers of health care services. Specifically, the implementation of this type of organization increases the mandate of payors over care providers.

However, despite utilization review health care costs have continued to increase. Utilization management increases administrative costs and as medical care is increasingly delivered in an outpatient setting,¹⁹ the costs of monitoring and authorizing utilization increase. Second, utilization review can adversely affect the quality of medical care for patients, leading to the need to undertake expensive procedures at increased costs. Third, utilization review does not fundamentally alter care provider incentives to over-utilize services under a fee for service mechanism. Care providers can continue to be opportunistic by “upcoding” services to charge higher prices, unbundling services to different categories to receive higher fees, and by increasing the number of visitations required during treatment or convalescence. Hence, this model does not fundamentally alter care provider and physician incentives to over-utilize health care services.

12.3.2 The Preferred Provider Organization

¹⁹ As the costs of hospitals increase, and medical technology improves to require less invasive procedures, there is a shift toward delivering more healthcare services at an outpatient site. However, this requires greater coordination for utilization review.

The preferred provider organization (PPO) is the second basic model of organizing managed care. This organization is formed through the combination of the provider network management role with prior roles. In this increasingly popular form of managed care, the preferred provider organization contracts with care providers, hospitals and labs to construct a network in which providers of medical services charge a discounted rate in return for a guaranteed number of patients. The providers must also accept utilization review, quality assurance, and outcome control. The PPO sells a prepaid health plan similar to indemnity insurance, but it restricts patient choice to providers that are part of the PPO network. Some plans enable patients to use out of network care providers and services if they are willing to pay higher deductibles, or assume close to full cost for leaving the network.

As PPOs are relatively easy to establish, numerous companies, hospitals, benefits consulting firms and insurers are constructing PPOs. Employers can purchase PPO plans from traditional insurance firms, join specialized PPO plans, or alternatively construct their own PPO through self-insurance and contracts with a third party administrator to administer, process claims and manage the plan. For self-insured PPOs the traditional insurance roles in the market place disaggregate. Employers hire benefits consultants to help them design a plan and assess the health risk of the organization and generally contract separately for different services in the network.

Constructing and managing a PPO requires good information on care provider practice patterns and qualifications to identify the physicians for the provider network. Information on employee utilization and medical risk is also critical to companies that self-insure to assess and forecast future

expenses. Information technology is playing an increasing critical role in providing this information. This is considered in detail later in this chapter.

Preferred Provider Organization forms of managed care further shift the relations among roles in the business network. There is the new specialized linkage between provider network managers and care providers. This leads to a specialized contract between payor and provider. Purchasers of health care contract with the provider network managers who in turn contract with with providers to provide services at a discounted rate. Purchasers and provider network managers commit their patients to care providers within the network. Furthermore, utilization review increases the leverage and mandate of the purchaser and network manager over the care provider. The relationship between the consumer and provider is also altered. The consumer is restricted in their choice to specific providers shifting the relation toward a specialized linkage.

However, the effectiveness of PPOs is still uncertain. Some studies show them to be highly effective at reducing costs, other show no difference. As PPOs retain a fee for service scheme, care providers can increase returns by requiring patients to make more frequent visits. Patients can also tend to over-utilize services if they are not the payor for services. PPOs can reduce costs by careful selection of care providers, and retrospective analysis of utilization to drop care providers from the network.

12.3.3 The Health Maintenance Organization

The third organizational model of managed care is the health maintenance organization (HMO). HMOs gained popularity in the 1970's after the HMO Bill was passed by the Nixon administration. In HMOs employers or individuals pay a fixed premium to the HMO. The HMO then provides all the health services for the patient, utilizing its own facilities for some and outsourcing others. Like a preferred provider organization, a health maintenance organization combines the provider network management role with many of the roles previously undertaken by insurers. However, instead of a fee for service arrangement, the health care providers generally receive a fixed fee for enrollment in the HMO.

Generally there are three different types of HMOs:

The staff model employs a group of doctors as care providers for a salary. Sometimes the staff shares in the HMO's profits based on utilization of performance. The HMO retains ownership of equipment and facilities used by the physician to provide medical care. In the staff model the doctor is part of the HMO hierarchy. Profit sharing with doctors can be implemented to provide incentives for efficiency.

In the group model the HMO contracts to a multi-specialty group practice for a fixed fee. Here the HMO primarily serves as a marketing and administrative organization to the multi-specialty group. The capitated fee structure is used to share risks. This is done to align physician as care provider and HMO incentives and reduce motivation for over-utilizing medical services.

In the independent practice association (IPA) model, independent physician practice associations are contracted to provide service to the HMO's patients.

The IPA physicians may also serve other patients. Physician fees are either discounted from the usual and customary charge, or the physician receives a fixed fee per patient.

As the HMO system shifts risks to care providers, cost containment incentives between care provider and insurer roles are better aligned. Also, as the plans are pre-paid with fixed annual reimbursements to providers, information technology in this form of organization is not as necessary for claims processing and related payment roles. Instead, it is used for some utilization management, quality assessment, development of practice patterns, and educating physicians on innovative procedures and for controlling the allocation of resources. These applications are considered in greater detail later in this chapter.

Of the different models for managed care the staff model HMO has shown the greatest promise and effectiveness in reducing health care cost inflation. However, HMOs give rise to new monitoring and agency problems in the business network. Specifically, HMOs can reduce costs by reducing quality or service to their patients.

12.3.4 Managed Care Organizations

All the above organizational models address health care costs in two different ways. They are all based on restructuring stakeholder incentives for utilization of medical services or the use of information technology and information to monitor and control stakeholder behaviors to attenuate opportunism and reduce over-utilization. Primarily these forms of organization are structured to influence and control physician practice patterns, as these practices are responsible for 80% of all medical costs.

However, employers and the different forms of managed care are also implementing co-payment schemes which shift some of the costs for the health plan and medical services from the employer to the patient. In addition to cost shifting, co-payment provide the patient with incentives not to over-consume health care services.

The health care business network is also characterized by change and turbulence. This is reflected in the variety of organizational models that provide health care services. As yet no one form of organization shows a significant ability to dominate over other forms of health care delivery. However, technological and demographic changes, and increases in the supply of physicians suggest that the staff model HMO may be an increasingly dominant model of managed care²⁰

Information and information technology applications are increasingly critical to the functioning and implementation of the above forms of managed care organizations. In remainder of this chapter we consider the emerging effects of electronic integration on roles and linkages in the managed care environment. Unlike the case of electronic filing where a single electronic integration has given rise to many transitions in the market, the emerging managed care business network is characterized by many different electronic integration applications. A selection of electronic integration examples and

²⁰Conversations with senior executives in insurance firms, HMOs as well as physicians identified three consistent views on the likelihood of staff model HMOs as a dominant form of organization. First there will be an over supply of physicians in the mid-1990s making it more feasible to employ physicians as part of an organization. Second, as technology advances and the number physicians in an area increases the cost of setting up new practices increases. Third, the number of women physicians is increasing and they show a preference for stable employment as well as a preference to be able to leave and return to workforce. This is more difficult for independent physicians.

their emerging effects on the health care business network are discussed below.

12.4 Electronic Integration and the Transition Managed Health Care

Information and information technology have become critical and strategic resources to organizations in the transition to a managed health care network. I now consider the role of information technology in this transition as well as the effects of electronic integration on the health care business network. These effects are illustrated through a series of case examples.

12.4.1 Expanding the Business Network: The Addition of New Information Technology Based Roles

A comparison of the emerging managed care roles-linkage model with the pre-managed care network illustrates the emergence of eight new strategically relevant roles in the business network. These roles represent new sources of value and influence the allocation of resources by firms that occupy different positions in the network. Information and information technology are critical assets to the provision of these roles in the business network. The examples below illustrate the criticality and importance of information technology in the provision of these roles in the network.

For example, utilization review (UR) is a critical new role in the network. Prior to 1983 there were a handful of companies providing utilization review. Today there are over 200 firms that sell utilization review services. In addition in 1990, over 95% of the population with job based coverage were enrolled in health plans with some form of utilization review (Schacht 1991).

Information technology is the critical technology for utilization review, which is used to control costs by ensuring that care providers do not overcharge or prescribe unnecessary treatments. Telecommunications technologies are used to communicate individual case information from doctors to nurses, and computers are used for decision support to determine if case procedures and treatments are consistent with national norms, and are warranted by the patient's case history. For example, at Health Care Compare, a leading UR firm, nurses review cases using computers to compare them with national norms prior to approving expensive treatments. If there are disagreements, physicians with Health Care Compare can then confer with the patient's doctors on future courses of treatment and hospital stays. Similarly, August International Corporation uses the technology to simplify customization of services for different clients (insurance firms versus self-insured employers). Indeed many market analysts identify the effective management of information technology as the critical success factor for firms in this industry.

The transition to managed care has also increased the importance of the complex provider network manager role. In the last twenty years the market shares of preferred provider organizations and health maintenance organizations which create value through this administrative role have increased substantially to cover 38% of the population with job based health care benefits (Schacht 1991). Information technology is critical for implementing this complex role. It is applied in decision support systems for market analysis, provider plan development and contract management, as well as in accounting and control applications for performance evaluation of providers. Information technology is also being used to enforce specific

policies of the HMO or PPO in relation to the provider. The application and effects of information technology on this role as well as on shared services provider, and credit provider roles are illustrated in greater detail in later parts of this chapter.

As information and information technology become a valuable new resource in the network, four other roles emerge as strategically relevant in the network for the provision of these resources. These are: information brokerage, and the hardware, software and communications provider roles. Information brokers collect, analyze and resell information that support either the decision making related to either the production or exchange activities in the network. Often the information brokerage role is combined with the software provider role to provide both decision support software as well as a specialized database.

Many firms have entered the market place for health care as information brokers and software providers. For example, Value Health Sciences (VHS), sells decision support software to assess the likely outcome of medical procedures, taking into account the medical history and other characteristics of the patient. This evaluation is based on analysis of medical outcomes data. Physicians and payors can use the system to determine the likely outcome of proposed procedures, or to identify better procedures. Typically insurers and HMOs use the VHS system to evaluate proposed procedures before they are performed and identify cheaper and more effective forms of treatment, or they use the systems to reject coverage for services which have a very low probability of success.

In contrast to using information technology to support the production of health care services, information brokers can also create value in the exchange process. Information technology can be used to value different procedures and services.

For example, provider network coordinators and employers can use claims data to design PPO networks that are cost-effective. Software such as "NetSelect" uses data from the Health Data Institute Data Base on physician charges and utilization practices and employees' utilization data to model PPO networks and to suggest changes that would save money, such as switching to lower-cost providers. Similarly, employers can also use information technology to determine the value of service offerings, such as HMOs as provider network coordinators. MEDSTAT Systems Inc.'s "RateCheck" system uses prior claims data to develop demographic profiles of employees and their utilization patterns. These profiles which are adjusted to account for demographic differences in the HMO population are then used to develop estimates of HMO rates based on local usual and customary charges. This is especially valuable as the pricing of HMO services has traditionally been difficult as HMOs generally do not provide detailed utilization data. Traditionally, HMOs attract healthier and younger employees, and their medical costs are generally less than those who enroll in an indemnity plan. If an HMO is not carefully priced, an employer offering both an indemnity plan and an HMO may incur a higher cost than for having all its employees enrolled in one or the other plan. This is because the healthier employees choose the HMO, making the pool of patients for the indemnity plan smaller and riskier. Typically, HMOs do not necessarily share cost savings from their healthier patient pool with the employers. Hence these information

brokerage and software services provide decision support in the creation, selection and evaluation of PPO network or HMO organizations.

Employees can also use information from data bases on care providers and hospitals for selecting a health care provider. Ryder Systems of Florida provides the MEDFACTS decision support system for employees that contains data on hospitals and care provider fees, specialties, education and board certification. Employees can call their benefits manager to request information on care providers and local hospitals. Ryder's information service can rank order care providers by fees, enabling employees and patients to become better informed consumers of health care. The service is especially useful for consumers that have to make co-payments, and the service can make the physician market place more competitive.

The VHS, NetSelect, RateCheck and MedFacts data bases illustrate the use of information technology to mitigate against *adverse selection* and increase the bargaining power of purchasers through better information. These systems serve to authenticate physician credentials, evaluate proposed treatments, provide pricing and quality information that enables the purchaser of health care services to improve the selection of service providers and reduce costs through bargaining.

As software, hardware and communications network provision become important roles in the health care network, numerous new firms enter the market and joint ventures emerge between providers in these roles and occupants of traditional health care provider roles. For example GEISCO and McDonnell Douglas play increasingly important roles as providers of value added networks for electronic claims submission and other communications

requirements. Prominent examples of joint ventures include IBAX, the partnership between Baxter and IBM, and various linkages between the telecommunications vendors (AT&T or Bell Operating Companies) and hospitals. Joint ventures combine the unique technical and financial resources of venture partners to provide products customized to meet the needs specific to the health care market.

To summarize information is a critical and valued resource in the transition to the managed care environment, and information technology provides the means to efficiently process and deliver this resource to different roles in the network. The above examples of electronic integration illustrate the emergence and effects of a variety of new information processing roles in the network, and the application of information technology in their implementation.

12.4.2 New Linkages: Extending Products, Markets and Influence

A corollary to the emergence of new roles is the emergence of new linkages to provide products and services in the marketplace. Below we consider how electronic integration strategies alter the pattern of linkages in the business network and give rise to new patterns of influence, products, as well as changes in product strategy and market structure.

Linking Roles to Extend Influence

Electronic integration enables firms to design new linkages across roles, and to extend the influence of occupants in a specific role over the behaviors of actors in other roles.

The use of information technology to increase the mandate of a specific group is illustrated by the emerging relations between care providers, pharmacies and provider network managers such as HMOs or payors. Traditionally, care providers mandated the prescription of specific drugs, often brand name drugs for patients. These prescriptions were usually precisely filled by a pharmacist. As payors try to reduce costs, and HMOs or preferred provider organizations implement prescription drug benefits as part of a health plan, these roles are using information technology to influence both pharmacy and patient roles to substitute generic or therapeutically equivalent drugs to fill prescriptions (Freundlich 1991; Schutte 1989).

HMOs and PPOs are using computerized drug formulary data bases for in house pharmacies to assist drug substitution. Indeed, not only do HMOs practice the substitution of generic drugs for brand name drugs, but they also substitute therapeutically equivalent drugs to reduce costs. These policies, implemented and supported by information technology, further reduce the traditional mandate of the individual physician over the pharmacy role and the treatment of their patients.

Drug substitution programs and pharmacy utilization review are not restricted within the boundaries of a single organization. As payors implement prescription drug benefits using pharmacy card based programs and prescription drug utilization databases, payors are able to significantly influence patient and retail pharmacy roles. By structuring co-payment regimes that favor generic substitution and with data bases on patient drug utilization, payors can influence the selection of pharmacists by patients, and selection of generic or therapeutic substitutions by pharmacists to fill patient

needs. Thus information technology can be used to extend the influence of an organization beyond its traditional boundaries. The new systems change the relative mandate of one group over another. In this example the traditional mandate of physicians over the pharmacy role is diminished relative to organizations that manage provider networks.

Another example of the use of electronic integration to alter mandate is illustrated by the earlier example of utilization review. Here payors use information assets and information technology to influence the behavior of physicians in the provision.

New Products and Markets

The Quattro card is a new product for health care consumers that combines claims administrative services, payment services and credit services. This product is implemented through a joint venture by American Express and John Hancock. Users of Quattro cards can visit care provider offices and use their card to purchase health care services. The portion of the bill covered by the insurance firm is handled automatically. At the end of the month the patient receives a single bill for co-payments which accrued from the use of services. This product reduces administrative costs and increases convenience to providers, consumers, payors and patients. Information technology is used to implement this service by providing credit to customers, benefits verification, electronic claims submission, and quick and efficient reimbursement to care providers, and hospitals. The demand for this type of product is increased by the shift to increased co-payments by employers.

While the provision of credit for medical expenses is not new, and a variety of credit card services have emerged to serve this market, Quattro is unique

in combining and coordinating a variety of roles to provide a unique product to customers.

Linking Roles to Differentiate Existing Products

Information and information technology are being used for differentiating existing products and services. Among small retail pharmacists, Yorke pharmacy combines traditional pharmacy roles with the information brokerage role in order to develop records of all individual prescriptions and transactions. Using information technology, the company prepares annual statements for its customers on the prescription drugs acquired by the customer. This statement is especially useful for elderly patients on Medicare, for whom prescriptions are tax deductible. By customizing service through the use of information technology, Yorke is able to differentiate its services and compete more effectively with larger pharmacies and mail-order pharmacies (Larson 1988). Specifically Yorke is investing in specialized information assets about their customers to provide added value to their customers. This specialized investment transforms a discrete relation into a long term relationship.

Indeed, one can imagine an extension of these information services to link both the traditional tax preparation market place and the health care market place, where the retail pharmacy is also a point of service for tax preparation. Such a product would represent integration across markets thereby further altering the structure of relevant roles in the business network.

To summarize new linkages arise across roles as firms undertake to provide new products and services and extend influence in the business network.

12.4.3. Electronic Integration: The Transformation of Roles

Transformation of Skills

The effects of electronic integration on the network as well as new information technology applications change skills required to undertake a role. This in turn can alter those who undertake the role.

For example, the skill requirements of benefits managers as purchasers of health care benefits for the organizations are changing the transition to managed care. As health care costs have a larger impact on the bottom line of the firm, the skill requirements of employee benefits managers includes more complex information processing tasks. They have to be capable of analyzing complex health care alternatives for the firm, evaluating the likely financial impact of choices on the firm, and managing relations with multiple providers. They also have to be skilled at using information technology to model and assess alternatives. Hence this role is becoming more analytical, informed and complex.

Indeed as skill requirements change those who undertake the role can change. For example, the authority for the health care purchasing decision as well as its evaluation, and selection of the health care plan is increasingly being shifted from the traditional benefits manager to the staff of the chief financial officer of the firm.

Transformation of Role Providers

At the organizational level, the structure and population of organizations that undertake a role is also being transformed. For example many retail

pharmacies are closing down, or consolidating to become a part of larger chains or consortia. These new organizational arrangements provide shared administrative services, implement pharmacy card plans, and also support the use of mail order prescriptions to reduce costs to patients. For example the Pharmacy Service Corporation provides a variety of shared information processing and administrative services to its member pharmacies. Similarly, hospitals are also consolidating to become part of regional or national multi-hospital chains.

One explanation for these transitions is that these organizations gain benefits from consolidation from administrative information processing economies of scale enabled by electronic integration.

Transformation of Role Status and Influence

The emergence of new roles enabled by electronic integration and new sources of value in the network is shifting the status and importance of specific roles. For example, various insurer roles are diminished in the network as the information brokerage and the network provider roles become more prominent. This is illustrated by the changes in centrality as identified by the network diagram.

In addition the implementation of information technology as a means for monitoring and control of care providers and other agents in the health delivery system is reducing the mandate of actors in these roles over actors in other related roles (pharmacies, labs etc). This is considered in more detail below.

12.4.4 Electronic Integration: Transformation of Linkages

A critical source of inefficiency in the health care system has been losses due to the agency problems of adverse selection or moral hazard. Electronic integration enables firms to redesign relations and mitigate against exchange risks. This is considered below.

Transforming Selection, Monitoring and Control

As medical costs increase, different actors in the health care network are using information technology to support the selection, monitoring and control of other actors that occupy different roles in the business network. As physicians control nearly 80% of resource expenditures, the use of information technologies to influence physician behaviors is a critical application of the technology.

As discussed earlier, information systems and services such as MedStat's "Rate Check" and Ryder Systems Information Services, provide both purchasers and patients with information that can guide selection of a particular physician. This can alter the relations between physicians and patients or employers to more specialized contracts. Other systems include the National Practitioner Data Bank, which provides the credentials of the physician and tracks the number, nature and status of physician's malpractice lawsuits. A second major application of information technology is in the measurement and monitoring of agent performance. Information technology is being used to collect, store and analyze information on the behavior of different agents in different roles in the network. The utilization review activities discussed earlier in this section provide an example of the use of information technology to monitor physicians.

As real time utilization review is costly (especially given the large volume of outpatient visits), typically insurers, PPOs and HMOs conduct retrospective utilization review. Analysis of claims, utilization or outcomes data can be used to to monitor physicians and develop new cost effective practice patterns. For example, hospitals use claims and other data to monitor doctors' practice patterns, such as the number of hospital referrals and the length of stay for patients. The data is analyzed to identify those doctors who cost the hospital money by extending the patient stay beyond the days approved by the payor. The data can be used to advise doctors to reduce unnecessary stays or to adopt other treatment procedures.

In addition, information technology is being used to identify opportunistic behaviors or fraud by physicians. Despite utilization review, physicians can still increase their incomes in a fee for service regime through a variety of opportunistic behaviors. These include the "upcoding" of services by using higher level codes for patients with insurance, increasing the frequency of required visits, and the unbundling of services and treatments to boost fees even when services are provided concurrently. Increasingly information systems (especially knowledge based application systems) are being applied identify and rectify such discrepancies in claims data before payment.

Third, information technology improves existing control mechanisms, whether they be behavioral or outcome control (Eisenhardt 1985). For example, the ability to measure and analyze utilization and outcomes data enables hospital administrators to specify more detailed incentive contracts, thereby reducing monitoring costs and improving measurement and evaluation for outcome control. Alternatively, prospective or concurrent

utilization review, or the implementation of drug substitution policies enforced by technology illustrates the use of information technology to directly influence the immediate behaviors of agents. This reflects improved behavioral control enabled by the improved coordination capabilities of the technology.

Transforming the Technology Linkage

Information technology applications are transforming the technology that intermediates linkage between occupants in different roles. Innovations in computer communications and high bandwidth telecommunications links are being used to interconnect specialists, physicians and hospitals in new ways. Tele-radiology systems are used by both hospitals and radiologists to reduce the need to co-locate specialists. This is efficient for leveraging professional radiology expertise over multiple hospitals. Computer conference systems, as well as satellite video networks are also used by hospitals and physicians to support education in new methods and techniques. Hence information technology is transforming the technology of linkage and the means of coordination among professionals in different roles.

Transforming Linkage: Customization

Electronic integration is also being used to change patterns of relations from undifferentiated and discrete relations between actors to specialized and longer term relations between different role occupants in the network. This is illustrated by the changing pattern of relations illustrated in the roles-linkage diagram.

For example, hospitals are investing in information systems to develop strategic partnerships with physicians. These include investments in a variety of physician support systems ranging from voice mail and answering services, to investments in providing shared physician office management systems, electronic access to patient records, and lab and radiology information. In addition, hospitals are providing leases for both information technology and medical equipment to physicians. While information technology based shared administrative services provide new sources of revenue for hospitals, there are other factors in their deployment. As competition among hospitals increases, this provides a means of building a stronger tie to physicians and influencing their behaviors in channeling patients to a specific hospital. Here information technology is used to raise the interdependence between occupants in the physician and hospital roles, as physicians traditionally are gatekeepers in mandating patient flow to hospitals. Physicians who adopt the use of the above systems develop greater dependence on these systems for maintaining patient records, and related information. They are of advantage to the physician as they reduce the time required to deal with administrative matters.

In addition, information technology is used to improve the coordination between hospitals, laboratories and independent physicians. Hospitals and laboratories are providing remote on-line access to patient files and test results for care providers such as physicians and radiologists. On-line access reduces travel time, coordination delays, and also enables hospitals and physicians to better utilize expertise. Second, as hospitals put schedules for operating rooms and other services on-line, they are able to improve coordination of these resources and improve their utilization. Third hospitals

can further augment this relationship with care providers or physicians by sharing information that enables the physician to be more effective in treating patients. For example the analysis of electronic patient records can identify if particular patients fall in a high risk category for a specific illness such as cancer or heart disease. This can trigger diagnostic tests and preventative care.

Thus information technology is used to reinforce a partnership in a context where physicians and hospitals have the shared objectives of providing efficient and quality care while maintaining a fee for service system. Indeed, many hospitals are forming PPOs or undertaking direct contracts with local employers that removes the third party intermediary such as an insurance firm.

The prior example of Yorke pharmacy maintaining and providing customers with a annual report on prescription expenditures for tax purposes also shows how investment in information assets can be used to convert a relationship from a discrete transaction to a repeated longer term relation.

Electronic Integration: Transforming Market Processes, Scope and Scale

Electronic integrations enable major transformations in market processes and alter the scope and scale of network operation. Examples of this are considered below.

Rationalizing Inter-organizational Processes:

The increased use of information technology to collect, store and analyze information, as well as requirements of the market for cost control are leading to the application of the technology to informate and rationalize the

basic processes in the network. For example, as health benefits become a major cost center in organizations, the purchase of health care is increasingly based on information rather than personal relations. Within firms the purchasing decision is being transferred from the benefits manager to the chief financial officer. As this transition occurs, employers and their consultants are increasingly demanding employee utilization data, as well as clinical data from PPOs and hospitals, in an effort to assess quality and efficiency. This data is being analyzed to determine the selection of providers, influence employee use of health care services and recommend ways of containing costs. Indeed, the capacity of insurers and employers to provide data and analysis in a timely and useful way is increasingly a key determinant in the selection of a particular provider. Increasingly many contracts are lost due to the inability of providers to provide data on medical incidents in a timely and efficient manner. This is forcing many insurers and network providers to respond to employer's demands for information by investing in information systems to provide both employee utilization data as well as tools for analysis of the data.

A second transformation at the network level is the development of standards and the construction of common infrastructures to support collective action across roles. For example, industry wide efforts at standardization are underway for specifying the content and formats for electronic medical records and claims. This will enable efficient information exchange at the level of the network.

The analysis of information from claims and medical records is the basis for further standardization or the construction of routines. For example information technology is being applied to analyze claims data and to define

standard practice patterns based on the use of outcomes analysis. This has the effect of beginning to standardize and reduce variations in medical practice. Second, outcomes analysis and practice is also being used to improve the quality of medical care. Specifically, this is used to construct new routines for the provision of care. In addition those provider network organizations such as health maintenance and preferred provider organizations are using real time data to manage the cases of individual patients throughout their entire treatment. Information technology is used to coordinate the delivery of care from multiple specialists and physicians to the patient in an integrated manner. The standardization of medicine is therefore beginning to reduce variation in processes of medical diagnoses and treatments and improve the quality of health care.

Another application of information technology to alter the market process is transformation of service pricing. Instead of the traditional fee for service regime there is an increasing shift to a fixed price regime. Analysis of previous pricing patterns, taking into account demographics and clinical factors, is used to develop standardized usual and customary rates for physicians. There is also shift to implement fixed price standards for prospective payments. Examples include the prospective payment systems, diagnostic related group based pricing systems implemented by the government.

Thus electronic integration leads to the construction of routines and new standards for practice and pricing in the health care network.

Altering Scale and Scope

The transition to managed care is characterized by many changes in the business network. As noted earlier electronic integration enables transformation of network scope. Specifically the number of different network roles increases, as does the complexity of administrative arrangements between them. As discussed previously different actors in the network are transforming the scope of their products and operations in order to take advantage of these new sources of value in the network.

Finally, as information technology is increasingly used to improve coordination and control over a variety of care settings and providers, the practice of medicine is becoming industrialized. Increasingly, coordination, control and the allocation of care resources is based on real time information, and on administrative or managerial discretion rather than the sole discretion of the physician.

The industrialization of medicine increase the scale of network coordination. Specifically, the number of roles in the network as well as the scale of administrative structures constructed to coordinate across previously separate roles increases.

Health maintenance organizations and the consolidation of hospitals into national hospital chains typify the emergent large organization that integrates many different roles to deliver health care. While information technology does not necessarily cause these transitions, it makes these transitions more economic and viable. Specifically it enables organizations to take advantage of economies of scale and scope associated with information processing in administrative activities.

12.5 Analysis of Electronic Integrations and Health Care Market Transformations

The health care market case study illustrates a variety of different electronic integrations as well as market transitions. This case study gives rise to four main findings discussed below.

A key finding is that the practice and delivery of health care is being industrialized. Specifically the transition to managed care is a transition to health care delivery which coordinated by new forms of large organizations: e.g PPOs and HMOs. Information technology is a critical coordination technology for these organizations.

Second, information technology is being used as a monitoring and control technology to alter the linkages between physicians and their principals or payors. Specifically utilization review and electronic drug formularies illustrate how the technology can be used to reduce the physicians mandate over the treatment of patients. This is especially important as physicians control much of the resource allocation in health care.

Electronic integration is transforming the nature of competition in the network to a more skill based and information resource intensive model of competition. First, as medicine is industrialized information technology is being used to construct new routines and standards of practice to improve quality. Second, the purchase of healthcare is increasingly information intensive to reduce adverse selection problems. Third information technology is being used to support transitions from distinct relations to longer term relations. The Yorke pharmacy example illustrates how

investment in information assets supports the establishment of long term relations. Various other linkages are moving toward longer term and specialized relations.

As information and information technology becomes a strategic resource in the network, the number of information technology based roles in the network increases. In addition as observed in the tax preparation case a variety of new linkages emerge to coordinate across roles and provide new products and services to the market. As new roles emerge in the market place the importance of traditional roles is diminished. For example traditional insurer roles are diminished as the provider network management role assumes critical importance in the provision of health plans.

12.6 Summary

The health care case study presents a description and analysis of the effects of electronic integration in a complex market place. It illustrates how many different organizational models may be implemented for the provision of similar goods and services (e.g utilization review indemnity, preferred provider and health maintenance organizations). Each form of organization represents different ways of coping with information processing requirements by structuring incentives and management control processes.

The case considered many different applications of electronic integration. Each of these applications either enable or lead to new forms of managing interdependence across roles or alter the structure of the network. The case illustrated transformations at many levels: the role, the linkage, and the network in terms scope, patterns of linkages and processes.

While information technology is a critical new resource in the control of health care costs, it is one of many possible levers available for health care cost control. Legislation, restructuring the incentives of different actors in the business network is another means available to restructure the network and address market inefficiencies.

Chapter 13:

Electronic Integration and Business Network Transformation

A Cross Case Analysis and Preliminary Theory

13.0 Introduction

In this thesis I have developed a role-based approach for conceptualizing and investigating electronic integration and transformations in business networks. In this chapter I develop a preliminary theory of the effects of electronic integration at the level of the network through a cross case analysis of the health care and tax preparation markets as well as other electronic integration examples. This theory stated in terms of a series of propositions, considers the common elements of most electronic integration strategies and the likely effects of these strategies on roles, linkages, network structures and processes. Specifically I consider the effects of new information technologies in transforming the provision of roles as well as the management of interdependence between roles. Next I consider how using information technology to alter information processing within business roles and linkages alters structures and processes within the business network. This establishes a preliminary linkage between events at the level of a role or linkage, and the structure and functioning of the business network.

13.1 Dimensions of Electronic Integration Strategies

Both case studies illustrate two dimensions to an electronic integration strategy: technology leverage and information leverage strategies for value

creation in business networks. Analysis of the two cases leads to two distinct propositions which are discussed below:

1.1 Effective and sustainable electronic integration strategies leverage technology and information.

1.2 Sustainable electronic integration requires comparative advantage in access to information, technology and capital resources.

Technology leverage strategies create value by exploiting the performance/cost improvements in information storage, communications, processing and input/output (Venkatraman and Kambil 1991).

Technology leverage is illustrated in the tax preparation case in the implementation of electronic filing by tax preparers to provide a rapid refund product. In health care technology leverage is illustrated by the provision of technology-based shared administrative services such as voice mail to physicians by hospitals as a means to enhance physician partnerships. The former exploits improvements in the performance and costs of communications technology, while the latter exploits economies of scale in providing a technology infrastructure.

Information leverage strategies create value through using new information made accessible by information technology applications to alter business processes, products and services. Information leverage in tax preparation is illustrated by the use of tax return data to devise marketing strategies to sell tax free bonds and other securities. In health care this strategy is illustrated by the analysis of utilization data (e.g use of NETSELECT), and physician histories (e.g use of the National Practitioner Data Bank) to plan and staff PPO networks.

Effective and sustainable electronic integration strategies combine both information and technology leverage. Technological innovation can reduce the value of a technology leverage strategy by making existing investments obsolete. This can reduce industry barriers to entry, enabling other firms who use cheaper and newer technology to enter the market. In contrast, information leverage strategies increase in value as more useful information is acquired and utilized as an asset by the firm. For example, in tax preparation we find a shift from technology leverage strategy of rapid refund toward strategies that combine both information and technology leverage. These include the provision of Instant Refund and related products. This suggests that firms will seek to combine information leverage with technology leverage as a means of electronic integration.

Technology leverage strategies have as an underlying asset technological equipment. It follows that technical know-how and capital to acquire the technology are the critical resources required for implementation. Hence firms with a comparative advantage in access to skill and capital are more likely to achieve and maintain comparative advantage through electronic integration. Information is the critical resource for information leverage strategies. The ability to access and accumulate relevant (i.e. at the right level of detail) and proprietary information, and the know-how within the firm to analyze the information, are the critical success factors for information leverage strategies. Thus firms that are able to acquire and renew information as critical and proprietary resources will have a comparative advantage over other firms in the execution of information leverage strategies. Thus comparative advantage in electronic integration is likely to be

sustainable if firms are able to maintain a comparative advantage in access to information, technology and capital resources.

13.2 Electronic Integration and the Transformation of Roles

Comparison of the two cases illustrates that electronic integration is a technological discontinuity in information processing activities underlying roles, and transforms the skill requirements and routines for performing these roles. These changes in skills and organizational competencies enabled by electronic integration can transform the population of individuals and organizations that occupy a specific role. Stinchcombe (1990) identifies a worker's skills as the set of routines and the principles of decision to select from among the routines or construct new routines for different tasks. Highly skilled workers know more routines and selection principles. They can also construct new routines. Less skilled workers know fewer routines and principles. Extending Stinchcombe's definition of skill, highly competent organizations are those with the knowledge and capability to select from and execute a large number of strategies. In this section I investigate how electronic integration changes skill requirements, the application of skills to tasks and the organization of role providers. Specifically, based on the cross case analysis, I develop five related propositions on the effects of electronic integration on skill requirements, routines and the provision of roles.

2.1 Electronic integration strategies create new skill requirements for individuals and organizations.

2.1.1 Electronic integration will be applied to automate information processing intensive routines requiring low skill levels. Automation

devalues those role providers whose primary contribution is low skilled information processing work.

2.1.2 Roles requiring medium levels of information processing skills (those tasks with high variety and high analyzability) , will apply information technology and electronic integration to match routines to tasks and to coordinate organizational capabilities. Electronic integration augments the performance and value of role providers.

2.1.3 For information processing roles characterized by low task analyzability and high task variety , electronic integration will be applied to support the construction of new routines to formalize tasks and coordinate the application of organizational expertise to tasks.

2.1.4. Routinization of role tasks enabled by electronic integrations increases managerial authority, thereby reducing individual discretion over job definition and role task activity.

Electronic integration alters the skill requirements for different network roles. For example the electronic filing initiative spurred the increased adoption of computers for tax preparation. This motivated the need to train tax preparers in new routines for the use of computers, communications and tax preparation software. In addition firms had to acquire computers, communications capabilities, and information technology management expertise within the organization in order to effectively computerize tax preparation activities. Thus electronic integration in the environment transformed the skills required to perform an existing network role.

Electronic integration also improves organizational efficiencies and effectiveness by enabling role providers to construct new routines or apply existing routines more efficiently to tasks. Indeed the construction of routines to perform different role related tasks, is a critical organizational activity (Cyert and March 1963; Nelson and Winter 1982). The effects of electronic integration on organizational routines and role provider skills will vary with the structure of information processing tasks required for a role.

For example, where low to medium information processing skills are required for a role, electronic integration will motivate the automation of information processing tasks and devaluation of individual skills. Here software can be used to automate both the execution of an information processing routine, as well as automate the principles for the selection of different routines. This is exemplified by tax preparation software that evokes different algorithms for estimating taxes for different classes of taxpayers. The use of tax preparation software devalues traditional skills of the tax preparer in identifying potential savings and estimating tax liabilities. Instead these skills are effectively programmed into the software which automates the process of return preparation.

For tasks requiring medium to high levels of skill, electronic integration can enhance the application of skills and change the ways in which workers learn, select and apply particular skills to problems. For example, artificial intelligence or data base systems can alert physicians to new possibilities in the diagnosis and treatments of patients. Alternatively, specialized software helps physicians simulate a procedure prior to its application on a patient. Communications based systems also improve the coordination of different

individual and organizational capabilities required to undertake a role. Hence electronic integration can augment the application of individual skills or organizational capabilities to address problems requiring medium to high levels of skill.

Where tasks are generally unstructured and a high level of role provider skill is required, electronic integration can support the construction of routines to improve the effectiveness of individuals performing the role. In the health care case study, electronic integration strategies were applied to the collection and analysis of information for constructing of new organizational routines to improve quality of care and increase efficiency. In the tax preparation case, bench marking was the basis for identifying and constructing new investment strategies to reduce future individual tax liabilities.

The different uses of electronic integration to routinize tasks and redesign roles can be summarized and illustrated by adapting the Daft and Lengel (1986) framework. The framework is used below to illustrate how the application of electronic integration will vary with different skill and information processing requirements as specified by different combinations of task variety and task analyzability.

Table 14-1: Electronic Integration and the Transformation of Tasks

Role Task Analyzability	High	Low
Role Task Variety		
High	<p><u>Medium Skill Level</u></p> <p>Electronic integration supports coordination of different task activities and the selection of appropriate routines to match different tasks. This enhances the application of individual skills.</p>	<p><u>High Skill Level</u></p> <p>Electronic integration supports the construction of new routines as illustrated by practice patterns.</p>
Low	<p><u>Low Skill Level</u></p> <p>Information processing tasks are automated when the tasks are frequent. This devalues the application of individual skills.</p>	<p><u>High Skill Level</u></p> <p>Electronic integration supports the construction of new routines as illustrated by practice patterns.</p>

The increased routinization and automation of tasks arising from electronic integration also increases managerial authority over individual or organizational role providers in the exercise of routines and roles. For example, outcomes and utilization data is used to specify new practice patterns for physicians in the treatment of patients. The increased routinization reflects greater managerial understanding of how to organize

the role activities as well as measure performance. As managers use information from management control systems to support the construction or implementation of administrative routines, the discretion of individual role providers over their jobs is reduced. For example, practice routines in health care are increasingly used to specify and evaluate the physician contact time with a patient²¹. This understanding, combined with the increased availability of data, enables both managers within the role or those within other organizations and roles to have increased control over specific role providers. The latter is considered in greater detail in the section on transforming linkage.

New information technologies alter the economics of information processing, reducing costs and enabling increasing returns to scale and scope. This, combined with the application of electronic integration to redesign work and specify new routines, can change the population of role providers. From the cross case analysis, I specify two related propositions.

2.2 Electronic integration transforms the economies of scale and scope associated with information processing activities within network roles. When the minimum efficient scale increases, individuals or organizations that occupy a specific role will consolidate into larger organizations or implement collective strategies coordinated through the use of information technology to realize returns from scale. Firms will diversify to take advantage of economies of scope.

²¹However, such changes in individual discretion and job definition can lead to organization conflict and resistance. For example a recent attempt at Harvard Community Health Plan to specify physician-patient contact time resulted in a physician revolt culminating in the resignation of the HMO's president [].

2.3 Changes in the economics of information processing as well as skill requirements and routines will enable new individuals and organizations who leverage their information processing technologies and skill to enter into the population of role providers.

For example, in tax preparation, the availability of tax preparation software reduces the cost of replicating the tax preparation service, thereby enabling firms to expand their size to serve more customers at lower marginal costs. Alternatively, banks and other financial services organizations are diversifying into the tax preparation market, leveraging their existing infrastructures to take advantage of economies of scope. Similarly the health care industry has been characterized by the development of large multi-institutional hospital systems which have the advantage of realizing increasing returns to scale purchasing supplies, equipment and in administration. To realize returns to scale, these organizations must be able to coordinate actions across the different hospitals or sites. These relations may be implemented through horizontal integration or alliances among hospitals to increase their effective purchasing power. These policies enable the organization to take advantage of economies of scale in purchasing.

The transformation of skill requirements, the design and application of organizational routines and changes in information processing costs enabled by electronic integration also result in changes in the population of role providers. For example, personal computers and widely available tax preparation software enable many individuals to provide fee-based tax preparation services on a part time basis to supplement their income. In addition, economies of scope enable banks and other firms to leverage their

information technology infrastructure to diversify into tax preparation at relatively low costs. Similarly various actors in the health care market place such as hospitals are diversifying to provide shared administrative services.

Routinization can change who undertakes various tasks in performing a role. In HMOs doctors are a more valuable and expensive resource than nurse practitioners, and other medical personnel. Initially, a patient may see a nurse practitioner; if the problem cannot be immediately resolved it is shifted to a physician. Filtering physician visits using a nurse practitioner redefines the physician's prior discretion in seeing patients as well as the skills he or she will likely exercise for the job. Thus routinization of tasks and transformations in skill requirements are likely to change the profile of individuals required to undertake different tasks in performing a role.

Hence the population of individuals and organizations within a role are transformed due to changes in skill requirements, organizational routines and the economics of information processing enabled by electronic integration. As information processing infrastructure and skills become more important in the provision of these roles those organizations with the requisite skills and infrastructure are most likely to adapt well to these transitions.

13.3 Electronic Integration and the Transformation of Linkages

Electronic integration strategies are increasingly applied to transform the management of intra- and inter-organizational relations between actors across roles. Based on the cross case analysis I infer the following propositions

on how electronic integration alters the management of interdependence between roles.

3.1 Technology leverage transforms coordination across roles toward the use of electronic media for distributed and asynchronous coordination.

As the costs of information technology fall it is increasingly used to intermediate coordination among actors in different organizations and roles. For example tele-radiology enables firms to leverage radiologists more effectively by using high bandwidth communications to transfer information between radiologists collocated at one site and physicians at many different hospitals. Similarly in tax preparation there is a shift from paper media to electronic filing. Hence firms increasingly use electronic media to substitute for other modes of communication, and the increased availability of communication bandwidth enables efficient distributed coordination without collocation.

3.2 Electronic integration as a specialized investment in information assets or technology to support linkage across roles shifts the relation between actors across roles toward more differentiated and/or frequent linkage.

Comparison of the health care and the tax preparation market place illustrate that many linkages in the network are being transformed from discrete and undifferentiated linkages toward unique and frequent longer term relations across organizations or individuals in different roles. For example, at Yorke pharmacy information technology is used to keep a record of all prescriptions. This record is provided annually as a statement of expenses to the customer for tax purposes. This serves to build customer loyalty.

Similarly, hospitals are implementing shared administrative systems such as voice mail, and electronic scheduling of hospital facilities to positively influence their relations with independent physicians. These systems serve to build loyalty and trust between the physicians and hospitals. (actors in two roles that have common interests) and favorably influence physicians as gatekeepers that control the flow of patients to hospitals. Thus specialized investments in technology can be used to differentiate and shift the relations toward greater interdependence and partnership.

In addition to transforming the linkage to a more unique and differentiated relation between actors, electronic integration enables actors to increase the frequency of interaction between roles. For example in the tax preparation case, H&R Block implemented a service on CompuServe to address tax related questions. This enables them to increase both their visibility and the frequency of contacts with their customers.

These examples illustrate the use of information technology to provide a higher level of service between organizations in different roles by using information or technology to differentiate and add value in the linkage. Alternatively electronic integration transforms the relation from a discrete transaction to a more frequent or long term relationship.

Electronic integration also alters the principal-agency or exchange relations across roles by changing the mechanisms for the selection, monitoring and control of actors in different roles. While this is not so critical in the tax preparation case, the health care case study provides many examples of how electronic integration is used to mitigate against opportunism risks, and

enable greater control for principals over agents. The cross case analysis leads to the following propositions:

3.3 Information leverage shifts the nature of control in principal agency relations from trust based forms of control to output and behavioral models of control.

3.4 The specification of routines and the real time monitoring enabled by electronic integration increases the mandate or authority of principals in a specific role over agents in other roles.

The health care case study illustrated the use of information leverage strategies to mitigate against the opportunism risks of adverse selection and moral hazard. For example, the national practitioner data bank as well as private data bases (e.g Netsselect, Ryder) used by insurers and benefits managers to select physicians or dentists to participate in managed care plans illustrates how organizations use information technology to reduce the risk of adverse selection. Specifically these databases change and complement the means of selecting physicians from trust in references and medical board certificates to the consideration of the agent's prior track record in practice and pricing. Hence there is a shift from primarily relying on trust in the reputation of the agent and referees to verification of the agent's prior track record.

Second, information technology is deployed to monitor the behavior of physicians and other providers in a health care plan to mitigate against the moral hazard. Systems are being implemented to ensure that the physicians do not overcharge by unbundling services. In addition, the information is used to influence the behaviors of physicians through practice patterns and

algorithms. Hence electronic integration leads to more cost efficient and effective implementations of behavioral and outcome control in principal agency relations.

The ability to monitor agents in real time also increases the mandate of principals in a specific role or organization over agents in other roles or organizations. For example, the use of pharmacy information systems enables HMOs and insurers to specify and implement a contract that specifies the substitution of generic drugs for specific prescriptions. Thus insurers and HMOs implement greater control over the pharmacist role by specifying the nature of their work.

In summary, electronic integration transforms the technology of coordination, the frequency and degree of specialized investments in linkage, as well as control mechanisms available to actors across roles.

The prior analysis has considered the effects of electronic integration on individual roles and linkages. The remainder of this chapter considers the effects of these transitions on the business network. Specifically I consider the effects of electronic integration on network strategies, structures and processes in the roles-linkage network.

13.4 Electronic Integration and Emergent Business Network Strategies

Electronic integrations as technological discontinuities in markets alter the available set of strategies that can be deployed by firms to achieve competitive advantage or supernormal profits. Strategies of the firm are defined in terms of the roles occupied and the means of managing interdependence between roles. The cross case analysis identified a variety of ways in which electronic

integration can be utilized to realize competitive advantage by new information and information processing capabilities to alter market structures and efficiency. These are stated as a series of propositions below.

4.1 Firms will deploy technology and information leverage strategies for competitive advantage through product and service differentiation. Hence we expect greater product variety in a marketplace influenced by electronic integration.

Differentiation strategies are fundamental to creating disequilibrium in markets and enabling firms to achieve higher than normal profits (Porter 1980; Tirole 1988). Technology and information leverage strategies enable firms to differentiate their products and services on new dimensions. For example in the tax preparation market, technology leverage enabled certain preparers to differentiate their product from other preparer's by offering Rapid Refund as a value added product. Similarly in health care, information leverage strategies enable insurers to provide customized and specialized benefits plans to customers. Numerous other examples of the use of information technology for differentiation are described in previous chapters as well as in prior research on information technology and strategy (Porter and Millar 1985; Rockart and Scott Morton 1984). Increasingly information technology is used to support the customization of service to specific clients.

4.2 Firms will invest in electronic integration to realize competitive advantage from barriers to entry or increased leverage from economies of scale and scope associated with information processing.

There are many significant economies of scale and scope associated with investments in information processing. Firms can undertake electronic integration strategies to realize these advantages. Examples include investments in shared services operations in the health care case study or the integration across roles as exemplified by the American Express Quattro card example. Prior examples of the role of information technology in giving scope and scale advantages are discussed in Porter and Millar (1985) as well as Clemons and Row (1987),.

4.3. Firms deploy electronic integration to coordinate strategies across different roles and product-markets for competitive advantage. Technology and information leverage strategies enable firms to exploit product complementarities and externalities through coordination in order to achieve competitive advantage.

A key new source of competitive advantage from electronic integration arises from new ways to manage strong or weak interdependencies across markets and roles. As the costs of information technology falls, firms are better able to coordinate across roles to exploit product complementarities and externalities. Thus new linkages are implemented to interconnect roles and coordinate strategies across firms and roles. The linkages result in the provision of new products and services in the market place and provide firms with the ability to leverage information resources across different product market segments for competitive advantage.

Integration and coordination across roles may be motivated by product or transaction complementarities. For example in the tax preparation case, tax planning and tax return preparation roles provide complementary products.

Information leverage strategies enable and drive the combination of both roles. Alternatively coordination across roles may be motivated due to transaction complementarities. This is illustrated by the Amex Quattro card. American Express and John Hancock as firms coordinate across multiple roles to provide a credit card that can be used by multiple providers. Through Quattro, the customer does not have to file claims. Instead Amex manages the payment and billing for customers to providers. Essentially information technology is used to simplify and integrate multiple transactions between roles into a single transaction. This often leads to one stop shopping by customers, and reduces the search and transaction costs incurred by customers.

Traditionally, the tax preparation and the marketing of tax-free securities were loosely coupled roles. However, The influence of the tax preparer role on the securities marketing role was characterized by a weak positive consumption externality between the two markets. Thus it was likely the tax preparation activity encouraged individuals to invest in tax free securities. American Express's innovation in the tax preparation market place was to coordinate strategies across markets with weak ties to capture benefits from positive externalities. It was their ability to internalize the externality through *information leverage* strategies to coordinate activities across these roles that led to a high sales of tax free securities.

Another example is the weak tie between tax refunds and their use by tax payers for consuming goods. Retail firms can internalize this externality through the use of information technology to coordinate and implement collective strategies with actors in other roles in the network. Specifically as illustrated in the tax preparation case, they can offer instant credit on a store

credit card against anticipated refunds. This way retailers converts a weak interdependence between activities into a strong interdependence. In the health care industry the provision of shared information services by hospitals is expected to create an information bond with providers. By providing these services to physicians hospital expect to benefit from the externality of physicians recommending more patients to them.

The existence of positive externalities between two roles and the ability to use information technology to efficiently coordinate between roles enhances the value of certain roles in relation to other roles in the network. The exploitation of an externality also generally leads to a formal administered linkage between roles.

The ability to differentially coordinate between markets or roles to influence purchasing behavior and pricing across markets can give firms competitive advantage. Furthermore, coordination across markets is a form of establishing barriers to entry to new firms, which must incur extra costs for such coordination, and provide integrated services. Hence the capacity to coordinate across roles and manage complementarities or externalities across roles constitutes a powerful new source of competitive advantage.

4.4. As more information is made available to decision makers and buyers for the pricing of products, suppliers will respond by unbundling or bundling products and services in ways to make their valuation difficult.

Electronic integration and the availability of information alters critical pricing strategies in the network. As information on prices and physician performance becomes more available, insurers are able to value and select physicians more easily. However, while detailed specifications can be

constructed, physicians also respond by unbundling products and services to constituent procedures to increase earnings or by "upcoding" services. This reduces the ability to price and compare services accurately and thereby works to obfuscate the price system.

13.5 Electronic Integration: Structural Transformation and Network

Extension

5.1 As firms deploy electronic integration, new information processing based roles become strategically relevant in the business network. These roles extend the boundaries of the business network, and create new sources of value in the network.

A cross case analysis illustrates that new roles emerge as strategically relevant , and influence the nature of competition in the business network. In the electronic filing case, the IRS initiative is a clear technological discontinuity in the market, giving rise to a variety of new roles in a business network (e.g the electronic filer role). Similarly in the health care market place, a variety of new roles become strategically relevant as the information technology is applied in the transition to managed care.

These new roles create value in the business network through technology or information leverage strategies. From the cross case analysis a variety of new roles to support the deployment of electronic integration strategies emerge as strategically relevant. These roles include communications network providers, software development, and hardware vendors. These roles provide the technology platforms and infrastructure necessary for implementing electronic integration strategies.

Other roles exploiting technology and information leverage also emerge as relevant in the business network. For example, as E-forms (Dertouzos) are implemented for electronic tax filing or electronic medical claims submission, this technology leverage strategy exploits the economies of scale and efficiencies enabled by information technology in input-output, storage, processing and communications. Similarly as processed information becomes a source of value, information brokerage roles or roles that apply information leverage strategies appear in the business network. Examples of information leverage include the analysis of taxpayer data for bench-marking and refining tax planning. Similarly, in health care we observe the analysis of medical outcomes data to develop standard practice patterns or assess the effectiveness of treatments (as illustrated by the products and services of Value Health Sciences).

While many of these new roles support the production of products and information based services by other roles, many of the information brokerage roles intermediate the exchange relations between different roles in the network. For example utilization reviewers monitor and analyze the practices of independent physicians for payors (e.g insurance firms). Indeed many of the intermediary roles exist to provide authentication, valuation, monitoring and other value-added governance activities identified in the second part of this dissertation. These roles serve to mitigate against opportunism and other risks that arise from uncertainty about the fulfillment of exchange relations.

The emergence of new roles in the network give rise to series of corollary propositions:

5.1.1 New linkages emerge in the business network as a consequence of electronic integration to integrate new roles into the business network.

A corollary proposition to the creation of new network roles is the emergence of new business linkages in the network. These linkages serve to integrate the new roles into the business network, identifying the paths by which different role providers influence each other, as well as specifying the mechanisms by which role providers manage interdependence between roles. For example in the tax preparation example the new electronic filer role is integrated into the network through a hierarchy or a partnership agreement with tax preparers. Alternatively the role may be integrated with a credit provider, or retailer roles using similar mechanisms to manage interdependence.

The emergence of new value-adding roles and linkages in the business network also alters the status of individual roles: or the relative value of the role to the rest of the network. For example:

5.1.2 The status of a role is increased in the business network if it is able to generate new informational resources or leverage other resources valued by other roles in the network through electronic integration. Firms will alter business scope to take advantage of these new sources of value.

5.1.3 Electronic integration reduces the relative value of a network role through technological substitution.

Both cases illustrate how electronic integration can alter role status: the value of a role in relation other roles in the business network. A positive change in role status is illustrated in the relative value of the return preparation role in a financial services network. From the case on tax preparation we note how

American Express as a traditional financial services firm altered its business scope and entered in the tax preparer role. To American Express, the tax preparer role was a valuable information resource for selling American Express's financial products such as stocks and bonds, as well as a valuable resource of customers for these products. Similarly in the health care market place many insurance companies are adopting equity positions in different utilization review companies. These firms provide valuable information for identifying physicians for managed care networks, and for monitoring and controlling network resources.

Electronic integration can also decrease the relative value of a role in the network through technological substitution. For example in the tax preparation network the relative value of the mail carriage role in the business network is diminished. This is because the implementation of electronic filing initiative has led to the substitution of information technology as an alternative means for communication between different actors in the network. In addition, the transfer of information into an electronic form for filing or preparation enables many types of analysis on the taxpayer data, increasing the value of these roles to other roles in the network, that traditionally were unable to economically gather or use this information.

13.6 Transformations in Business Network Processes

6.1 Electronic integration leads to the routinization and formalization of inter-organizational processes.

Electronic integration was shown to increase routinization of tasks within roles. It also leads to increased routinization of various inter-organizational

processes, such as purchasing (through the implementation of EDI), evaluation of potential traders (Ryder's credit check), and payments and settlement systems (claims and other transaction processing systems).

6.2 New coordination capabilities from electronic integration and the formalization of routines enables firms to extend their influence across multiple roles without ownership.

The ability of firms to construct formal routines, and the ability to monitor across organizations enables firms to extend the range of their control over processes external to the organization. This is exemplified in health care by the preferred provider form of organization which implements utilization review.

6.3 Transaction management and other aspects of the inter-organizational relation will be increasingly routinized and governed by rules developed by trade or standards associations.

Industry trade or other professional associations play an increasingly significant role in constructing and implementing administrative rules and specifying standards for inter-organizational routines. Hence the influence and control of standard setting bodies that develop collective mechanisms for inter-organizational administration can be a critical source of competitive advantage. In summary, electronic integration leads to the construction of fixed patterns of inter-organizational behavior. This requires firms to participate in new structures of collective governance.

Conclusion and Summary

This chapter developed an inductive theory of network transformation based on a cross case analysis. Specifically, business network transformation was considered in terms of the effects of electronic integration on roles, linkages, business network strategies, structures and processes. This theory was stated in terms of a series of propositions.

The analysis and preliminary theory illustrates how electronic integration makes available new information and information processing resources in the business network, and how firms utilize and re-organize the network to take advantage of these resources. Specifically, technology and information were used to construct new routines or automate existing organizational routines, thereby altering the skill requirements and population of role providers. New information resources, the routinization of roles, as well as coordination capabilities enable new ways of managing interdependence between roles. Hence the pattern of linkages between roles moves toward more complex information intensive mechanisms.

Electronic integration also provided firms with new strategy options for differentiating products and service through information and technology leverage, creating barriers to entry. Firms can also engage in new modes of competition through coordination and exploiting complementarities and externalities across different product-market segments, and roles. Larger firms are likely to be more capable and effective at such integrative strategies across roles.

The exercise of the above strategies leads to transformation of the business network - increasing its size and complexity in the number of roles and pattern of linkages established to manage interdependence between firms.

Some roles become less important as new information processing based roles become a strategic asset in the business network. In addition, inter-organizational and business network processes are increasingly routinized, and standards are set by third party organizations. Thus influence over standard setting is critical to shaping the network.

The next chapter extends the analysis and considers the preliminary theory in the context of prior organizational and strategy theories and develops implications for the practice of electronic integration.

Chapter 14:

Electronic Integration, Strategy and Structure - The Preliminary Theory Reconsidered

14.0 Introduction

In the previous chapter I developed a descriptive role based theory of the effects of electronic integration at the level of the business network. This descriptive theory identified the key dimensions of electronic integration strategies, as well the effects of these strategies on the roles, linkages and the structure and processes in the business network. However, the theory is not prescriptive and provides few normative guidelines as to how managers should implement electronic integration strategies, or how to position the firm in environments that are being transformed by such strategies.

The purpose of this chapter is to:

- situate the findings of this emergent theory in relation to prior theories and frameworks that relate information technology to strategy and organization design,
- highlight the similarities and differences of the inductively derived theory from the extant theory

Given the lack of a single dominant paradigm that guides information technology based strategy development at the level of the business network, I consider the findings of the cross case analysis from three different and complementary perspectives that provide insight in the use of information technology to transform business networks. These are denoted as the

information technology-business strategy perspective, the business governance perspective, and the political economy perspective. To date the former two perspectives have dominated the literature relating information technology to strategy and structure. However, the political economy perspective adds to our understanding of the motives, deployment and use of information technology in networks.

In this chapter I will evaluate the relevance of the above perspectives and their strengths and weaknesses in explaining phenomena observed in the case studies and highlight similarities and differences from the preliminary theory. This critical evaluation of theories highlights limitations in the application of existing theories to the level of the network. Extensions to the roles linkage model and a strategy for theory construction are considered in greater detail in the next chapter.

14.1 The Information Technology - Strategy Perspective

The literature to date on information technology and strategy primarily relies on industrial organization economics as a reference discipline and more specifically Michael Porter's models of competitive strategy and advantage. Building on earlier research in industrial organization economics (Caves 1980; Scherer 1980), Porter's structuralist perspective specifies that the attractiveness or profitability of an industry depends on its structural characteristics. Specifically Porter identifies five forces that determine industry attractiveness and profitability: the threat of entry, bargaining power of suppliers and customers, the threat of substitutes, and the intensity of intra-industry rivalry. These forces determine the prices that can be charged for goods or the cost of goods supplied. Porter suggests that an industry is less

attractive and less profitable as the five forces increase. He suggests that by changing the structure of the industry and altering the five forces, the industry can become more profitable and attractive. In addition to altering industry structure characteristics, Porter identifies two generic strategies for competitive advantage within an industry segment: cost leadership or differentiation. Firms can either compete by being the lowest cost supplier of a good or service, or by differentiating and in some instances focusing their product or service to particular segments in the market. Sustainable competitive advantage comes to firms from effectively managing the various activities in its value chain to realize value for customers through lowering cost or differentiation.

Many authors in information systems and strategy have previously adapted the Porter framework to illustrate how information technology can be applied as a competitive weapon, to alter structural characteristics of an industry or implement cost saving or differentiation strategies. The case studies and preliminary theory provide examples of electronic integration consistent with Porter's strategy framework. The cases in this dissertation have illustrated examples of differentiation strategies through the use of technology and information leverage (e.g rapid refund and bench-marking in tax preparation), as well as the deployment of technology to reduce the bargaining power of suppliers (e.g decision support systems to price medical services) or alter the bargaining power of customers through investments in specialized linkages. Indeed analysis of the roles linkage models, which have adapted the notion of value activities, also illustrates how information technology improves value creation within specific roles. The cases show information technology can improve both the quality and efficiency of role

provision through the construction of routines, as well as improve the delivery of value by enabling effective management of interdependence between roles. Thus at a cursory level the applications of information technology seem consistent with some of the predictions of the Porter framework for the use of technology.

However, while many information technology and strategy researchers suggest that investment and adoption of information technology can be considered to increase barriers to entry within the industry, the case studies showed mixed results on this issue. Indeed new information technologies as well as software, lowered entry barriers into specific roles. For example some actors in the business network were able to leverage prior investments and skills in information technology and management, and enter new industries where electronic integration became important (e.g American Express's entry into tax preparation).

Applying Porter's strategy framework gives rise to the following implications for strategy and linkage in the business network. In this voluntaristic or strategic choice model information technology investments are differentiators or cost reducers, capable of altering the structural characteristics of industry. Technology can be a source of barriers to entry, especially if there are economies of scale or, alternatively, externalities associated with providing a technology based service such as network service (Allen 1986). Information and information technology can be used for differentiation and to coordinate across roles and firms, supporting vertical integration or the management of long term relations.

However, there are many limitations to applying this strategy perspective to the analysis of electronic integration and business transformation. It is generally a focal firm perspective restricted to the analysis of a single industry - a particular class of product market. The framework does not adequately address how to manage firm strategies when there are interdependencies or externalities between industries or complementarities between products. Indeed a key phenomenon identified in the cross case analysis was the exploitation of weak interdependencies and information asymmetries across distinct industry segments, and the emergence of coordinated strategies implemented across different product market segments. These strategies could be implemented through coordinated action across different roles within the boundaries of a single firm, or through strategic alliances of many different firms. The efficacy of these coordinated strategies in enabling firms to achieve economic dominance as well as the different types of coordinated strategic behavior is still unclear.

Second, the Porter framework does not adequately address how firms should select to position in the value adding roles across multiple industries, or how to manage interdependence between roles or organizations. Should firms undertake alliance strategies or internalize the externalities through horizontal integration? Indeed, Aghion and Bolton (1987) show how alliances and long term contracts between firms, like vertical integration, can also constitute barriers to entry along the value chain. While the structuring of optimal contracts is a central issue in industrial organization theory it is not substantially addressed within the Porter framework. The model focuses on vertical or horizontal integration as the primary means to coordinate and influence activities across roles.

Hence the traditional information technology and strategy literature which relies on the Porter framework identifies some ways of deploying information technology strategically. However, it does not provide adequate guidelines or a theory for strategy at the level of the network, and does not adequately address the complex electronic integration strategies identified in the cross case analysis. Specifically, the model does not discuss how firms should select to position and compete in value adding roles across industries, or how to manage interdependence between roles and integrate a specific role into multiple value chains that collectively specify a business network. Unlike the theory developed in the last chapter, the traditional information technology-strategy literature also does not address the processes and means by which roles and linkages are transformed by electronic integration.

14.2 The Business Governance Perspective

The business governance perspective is the second structuralist perspective most commonly adopted in the analysis of the relations between information technology, strategy and structure. This perspective has been considered in detail in the first part of this dissertation and is primarily suited to analysis of exchange relations at the level of the dyad. Agency or transaction cost economics is used to explain transformations in organization linkage. New information processing technologies are applied to reduce transaction costs or agency costs, thereby altering modes of control (Eisenhardt 1985) or the efficient boundaries of the firm, leading toward more market like modes of transactions (Bakos and Treacy 1986; Malone and others 1987)²². While the

²²Typically this perspective is a technologically deterministic perspective of business network restructuring. The network will restructure based on firms that deploy technology to capture

cross case analysis highlights the use of information technology for the valuation of products and services, as well as monitoring of agents thereby altering control mechanisms, it is not clear that electronic integration leads toward more market modes of organization. Instead, information and technology is used to facilitate the management of more complex modes of linkage that transcend normal industry boundaries. Both cases analyzed in this thesis illustrate a general shift from simple market exchanges to more complex modes of managing interdependence between actors across roles.

As firms seek to differentiate their products and services, and reduce the slack resources in the network, information technology is increasingly used as a specialized investment that increases the commitment of parties in an exchange relation to move toward a long term and specialized coordination arrangement. A second reason for more complex modes of managing interdependence between parties is that it facilitates the diffusion of innovation in system. For example, in a staff model HMO the provider network manager has both the authority to specify new routines, as well as the capacity to diffuse new approaches to managing health care delivery within its system more efficiently than in an indemnity model of health care or in many preferred provider organizations. Thus a critical limitation of the traditional institutional economics approach to designing linkages is that it is primarily a static model of designing efficient inter-organizational or inter-role relations. It does not address modes of organizing to capture gains from learning.

agency and transaction cost efficiencies. The invisible hand of the market will naturally select organizational models that are transaction and agency cost efficient.

A more extensive critique of the traditional perspectives on designing governance mechanisms was provided in the first part of this dissertation. In addition it is primarily a dyadic perspective and the appropriateness of its application to constructing organizational networks that combine many distinct roles is not clear. Indeed, preferred provider organizations and health maintenance organizations increasingly represent complex organizational networks, coordinating and combining many different modes of organization across roles to deliver services to customers. This leads to the question whether local optimization in the design of exchange relations across organizations in two distinct roles leads to conflicts and sub-optimality in organizing a more complex inter-organizational networks for the deployment of the complex strategies identified in the cases.

Hence while the descriptive theory developed in the cross case analysis is consistent with the predictions of business governance or institutional economics perspectives for the use of technology, the applications of information technology in complex strategies within the business network highlight more complex processes at work in shaping the structure and pattern of linkages in the business network.

In summary, both the traditional IT strategy and institutional economics perspectives provide partial explanations for the motivation and use of information technology in business network. Critical limitations of the prior application of these models to explain the linkage between information technology, strategy and structure are that they have not traditionally focused at the level of the business network and are primarily static frameworks. The models which prescribe desirable end states do not explain the processes and

interaction between technology and organizations in the structuring of networks. In contrast the descriptive theory developed in the last section describes how information technology affects both roles, linkages, as well as the pattern of linkages.

14.3 The Political Economy Framework

The above economic perspectives primarily focus on deploying electronic integration to increase economic dominance or efficiency. A third and complementary perspective is the political economy framework (Aldrich 1979; Benson 1975). In this perspective, firms compete not only in terms of price, and differentiation, but exist in a political economy where they compete for control of processes leading to rules that govern the accumulation of resources in the network. Electronic integration is used as part of a wider set of strategies to increase power and structural dominance in the network. In this model firms compete for authority to restructure and stabilize critical resource flows. Thus the structure of vested interests, the power of organizations and their ability to structure the behavior of others through political and other mechanisms is a critical issue of concern to the political economist.

Political economy and network theorists identify three related sources of power in networks: resource control, network centrality, and legitimate authority. Benson (1975) Pfeffer and Salancik (1978) have shown how differential access and control of resources increases the power of actors. Network centrality refers to the power that accrues from being central to many activities and functionally indispensable. Authority provides the capability to specify rules on the functioning of activities and resource

allocation in the network. Electronic integration can affect all of these sources of power, thereby altering structure and processes in the network. Electronic integration by altering the basis of power in networks through new information and technological capabilities, can alter the political economy of the business network and the inter-organizational field. The political economy can be characterized by four structural components: administrative structure, system coupling, multiplexity of ties, and new network resources (Aldrich 1979; Benson 1975; Stern 1979).

Administrative structure refers to the means by which firms within the network may limit the discretion of other network participants by developing formal rules of interaction and resource allocation. For example HMOs and PPOs influence the allocation of medicines by pharmacies using information technology to maintain and support the execution of complex administrative rules. Alternatively, insurers and payors use utilization review firms to specify and authorize payment for treatment of patients. Electronic integration is vital to the implementation of these systems which increase formal authority of actors in the network.

The importance of political processes in the development of the modern health care system was already considered in the earlier chapter. Physicians used both their knowledge as well as their political influence to construct and maintain a fee for service system. Today physicians are responding to utilization review activities and changes in administrative structure that reduce their professional dominance through legislative initiatives that seek to standardize procedures, implement training and limit utilization review in different states.

Centrality in the network makes organizations indispensable, giving them a source of power. We expect firms to assume new central roles in the business network. Electronic integration was shown to alter the centrality and importance of roles in the tax preparation business network toward electronic filing and in the health care network toward the provider network manager. Various organizations in both networks are diversifying into these roles.

Multiplex ties between actors promote stability in exchange relations. In the health care example, hospitals were implementing shared services to physicians as a new service to encourage their loyalty in referring patients to the hospital. Similarly in the tax preparation example, new ways of making a discrete relation into a repeated relation, such as the use of the electronic network for ongoing tax tips and advice illustrate how firms may use technology to implement multiplex ties with other organizations and individuals who provide them with critical resources. Hence, the degree of coupling is transformed towards tighter linkages through the use of information technology. Electronic integration also supports the administration of multiple ties within and between organizations.

Electronic integration also enables firms to have differential access to new information or information processing resources of value in the business network. These new network resources differentially enhance the power of these actors in the business network who have the capital resources and the capabilities to implement information technology based strategies. Indeed in both cases information leverage strategies were increasingly critical in reshaping the business network.

Thus electronic integration can be used by firms to alter their power, and the political economy of the business network. In the political economy framework firms are expected to deploy strategies that stabilize resource flows and increase structural dominance. Examples of these strategies are evident in both case studies.

Conclusions

In this chapter I have examined electronic integration and business transformation from three perspectives. The comparison of the cross case analysis findings to three complementary perspectives identified three distinct motivations for, and ways of, using information technology in networks. These are: to change industry structure or support price leadership or differentiation strategies to increase industry profitability and support competitive strategy; to use information technology to improve monitoring and reduce transaction costs and opportunism risks; and to use technology in networks to increase structural dominance and power through altering the political economy of networks.

However, the descriptive theory developed in the last chapter illustrated that electronic integration was a means of implementing complex strategies across different markets coordinated across many firms or actors. In addition, the descriptive model identified that linkages across roles, as well previously segmented industries, were generally becoming more specialized and long term. The dominant strategy and structure models do not provide a theory of how to position in roles, design linkages or undertake strategy in markets characterized by these transformations. Specifically, they provide few normative guidelines for how firms should organize internally, and manage

interdependence with external organizations to take advantage of new opportunities arising from electronic integration.

An emergent organizing principle is to organize around the core competence of the firm. Prahalad and Hamel (1990) define core competencies as the collective learning in the organization on coordinating diverse production skills, and integrating streams of technology around a specific capability e.g miniaturization for Sony. Such a capability or core competence provides firms with access to a wide variety of markets, and are difficult to imitate. The core competencies are embodied in the skills of the people, and information and knowledge are the critical assets required to sustain leadership.

Electronic integration in organizations enhances the core competencies of firms by providing the information and processing capabilities to facilitate organizational learning. Second, technology provides the coordination infrastructure to leverage the core competence. Indeed, organizational networks connected by alliances and partnership modes of coordination and influence are increasingly the means by which firms translate their core competence into products and services of value. However, the efficacy of this organizing principle is still to be verified.

As firms develop complex organizational networks, and execute strategies across different industries, new approaches to represent and measure firm strategies, structures and performance in networked markets are required for business visualization and theory construction. Much remains to be done in developing efficient representation schemas and data collection techniques to support the creation and verification of a theory of business transformation

and strategy at the level of the network. These issues are examined in the next chapter.

Chapter 15:

The Roles-Linkage Model: A Critical Evaluation and Proposals for Extension

The acts of the mind, wherein it exerts its power over simple ideas, are chiefly these three: 1. Combining several simple ideas into one compound one, and thus all complex ideas are made. 2. The second is bringing two ideas, whether simple or complex, together, and setting them by one another so as to take a view which it gets all its ideas of relations. 3. The third is separating them from all other ideas that accompany them in their real existence: this is called abstraction, and thus all its general ideas are made.

(Locke 1690)

15.0 Introduction

The previous chapter highlighted the lack of an adequate theory of technology, strategy and structure at the level of the business network. The purpose of this chapter is to critically evaluate the roles-linkage model as a research tool for the study of business networks, and as a management tool to

support strategy formulation. The motivation for developing the roles-linkage model was the need to better represent and understand the interaction between technologies, environment and organizations at a time of increased turbulence, transformation and complexity in organizational environments.

As discussed in the introduction to the roles-linkage model, its purpose is to provide an abstraction method for systematizing and representing business networks. Specifically, the model seeks to: (a) provide an abstract representation that focuses on the salient constructs required to characterize business networks; (b) provide a means of classifying and comparing transitions in business network structures; (c) guide managerial analysis and strategy development in business networks and environments.

In this chapter I consider the strengths and weaknesses of the roles linkage model based on experiences in applying the model to the tax preparation and health care markets. I also identify possible extensions required to improve its utility as a research and management tool and propose a strategy for its use to support theory construction at the level of the business network.

15.1 Evaluating the Roles Linkage Model

15.1.1 The Roles-Linkage Model as a Research Tool

For the last thirty years management scholars have studied various themes in the strategic management field. Empirical studies include those that explore the linkage between: strategy and structure (Chandler 1962), generic strategies (Porter 1980), strategy and performance (Rumelt 1974), and the environment and strategy (Lawrence and Lorsch 1967). Recently,

information technology has become a critical new factor in shaping both organizations and environments. However, research on the interaction of technology, organization and environment has been characterized by some major limitations. While theorists argue that technology can transform organizational and environmental structures, the research to date is sparse and does not show how or why specific information technology applications simultaneously transform organizations and environments at the level of the network. A critical problem for theory construction and empirical research has been the lack of consensus on key constructs and a suitable mechanism for representing the structure of environments and organizations simultaneously at the level of business networks.

The roles-linkage model provides a representational schema for business networks defined in terms of roles and linkages. This definition focuses research attention on the salient elements of the network structure and provides a means of coping with informational and conceptual complexity of real business networks. As illustrated by the case studies the model enables researchers to analyze the effects of electronic integration strategies and other policies at the level of each individual role, while simultaneously considering comparative information and effects in relation to all other roles in the business network. Hence the roles-linkage model encourages systems thinking.

The roles-linkage model extends traditional Social Network Analysis (Tichy and others 1979) representations of organizations and environments, by conceptualizing both organizations and their environments in terms of two generic and abstract constructs: roles and linkages. This abstraction is useful as it provides a parsimonious representation of the network in terms of two

constructs: *roles* which focus the researchers attention on value creating processes and behaviors in the business network, and *linkages* which focuses on how specific actors and stakeholders within roles manage interdependence between roles. By representing business networks in terms of links between roles, rather than between specific organizations (as is commonly done by traditional social network analysts), a roles-linkage model provides a visually compact and comprehensive model of a business network, in terms of analytically meaningful constructs. In addition, the six categories of linkage provide a parsimonious typology of how specific roles can influence and manage interdependence with other roles. This reduces the complexity and the information processing required for researchers to comprehend the structure of business networks.

This representation is especially useful for characterizing emerging organizational forms and patterns of organizational influence. The distinction between an organization and its environment becomes increasingly blurred as organizations adopt new modes of governance to structure and influence interactions with their environments. For example, any organization's structure, and to some extent its strategy, can be summarized in a roles-linkage model, which represents interdependence of roles within the boundaries of the firm by hierarchical forms of linkage. Its interaction with the environment is characterized by the patterns defined by its other linkages. This representation provides a useful snapshot in time of an organization. Roles-linkage models representing different times can be used to identify areas of organizational transformation, and patterns of strategic action.

The representation is also useful for examining how a transition in technology underlying a specific role affects both the relations between occupants in that role, as well as relations with other roles. In addition, the model can be used to identify likely paths by which technological transitions influence other roles.

15.1.2 The Roles-Linkage Model as a Tool for Strategy Development

Strategy development is a cognitive and information processing intensive activity in organizations. To develop a strategy, managers generally undertake two inter-related information processing activities. First, they collect and process information on the external business environment. This is used to identify market trends, threats to existing business activities or new opportunities for investment, profits and growth. Second, managers collect information to identify and consider the internal competencies and capabilities of the organization. These two activities provide the information base for strategic positioning decisions: the definition of core businesses to be undertaken within the boundaries of the firm as well as the relations and the means by which the firm governs relationships with its external environment in order to achieve competitive advantage.

As strategic planning is primarily an information processing and cognitive activity, the strategist's thinking patterns provide a bridge between environmental and company circumstances and strategic actions. Emerging research in strategy and organizations supports the view that managers are confronted by a kaleidoscope of facts, myths, rumors, and beliefs about their organization and environment from which they "enact a reality" to model their perception of the environment. Enactment (Weick 1979) is a process

of actively bracketing experience into concepts, and defining relations between concepts. The process of enacting an environment is generally guided by schemas which can be likened to the format of a computer program. Accumulated experience in the form of templates, or formal models and frameworks, provide schemas to guide information processing, inference, decision making and enactment of environments and strategy. Kiesler and Sproull (1982) have shown how managers' schematic knowledge affects their perception of the environment.

A variety of schemas exist to assist managers with the strategic planning activity. These include the industry competitive analysis, value chain analysis (Porter 1980), and portfolio approaches. These frameworks are important to managers as they organize the simplify the strategic planning process, uncover strategy assumptions and alternatives, and reduce uncertainty associated with the process.

Specifically these schemas and frameworks guide both the *representation* and *formulation* of strategy. Representation refers to the use of schemas for:

- organizing information for strategy formulation and analysis,
- presenting or communicating the key features of a business's external or internal strategies.

Formulation refers to the use of frameworks and tools for:

- selecting and collecting environmental and organizational variables considered important,
- structuring information analysis,

- identifying strategy alternatives given the current capabilities and the position of the firm in an environment,
- structuring the management decision making process to facilitate consensus formation on both the strategy planning process and its outputs.

Most strategic planning tools provide structure to the processes of both representation and formulation. However, models and tools vary in the degree to which *representation* is highly structured, or *formulation* is highly formalized. A typology to classify strategy frameworks and tools can be defined in terms of the degree of structure in representation and the degree of formalization in the formulation process. The table below applies this classification to different frameworks that support and systematize the strategic positioning decision.

		Formulation	
		Less formal	Formalized
Structured		Generic Strategies and Visualization (Gonzalez and Mintzberg 1991; Mintzberg 1988)	Portfolio Matrices: BCG, ADL, GE
Representation			Industry Competitive Analysis (Porter 1980)
Unstructured		*not useful*	

Figure 15.1

Portfolio frameworks such as the BCG growth share matrix, the GE-McKinsey industry attractiveness matrix and the ADL life cycle model provide highly structured representational approaches and formalized rules for formulating strategy. A key contribution of these of portfolio models is the notion that “generic strategies” are available to business units that occupy different positions in the portfolio matrix. For example, the classic Boston Consulting Group growth share portfolio model identifies four generic strategies of hold, harvest, divest, invest for growth (Hax and Majluf 1984). Generic strategies provide managers with a typology of strategy alternatives and guide the strategy formulation process.

In contrast to portfolio approaches, new strategy formulation frameworks more grounded in empirical research and economic theory were developed

in the 1980s. As discussed in the last chapter, Michael Porter's Industry Competitive Analysis established clear conceptual linkages between firm strategies, and characteristics of the environment, and developed implications for industry attractiveness and firm profits.

The above approaches provide formalized approaches to strategy formulation. In contrast, the roles-linkage model is a schema that provides structured representation, but no formalized methods for selecting strategies. Similar examples of schema construction include the work of Mintzberg (1988).

Motivated by the proliferation of strategic planning approaches and "generic strategies" developed by consulting firms and academics, Mintzberg develops a representational system and a typology of business strategies to classify and reduce the variety of "generic strategies". This framework uses structured representational schemes but does not formalize the process of selecting specific strategies. Specifically, Mintzberg (1988) identifies five types of business strategy available to firms. In addition he considers the importance of interdependence between the firm and the environment, and develops a representational scheme for illustrating the core business as part of a network or matrix of other interdependent businesses and industries. This is illustrated in Figure 15.2

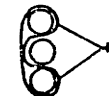
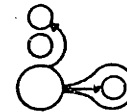
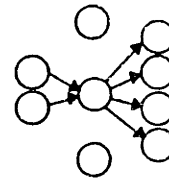
While the original representational scheme relied on the business or firm as the elemental unit, in more recent work Mintzberg moves away from using the core business as a unit of analysis toward what appears more like a role. Figure 15.3 highlights Mintzberg's representation of the market place for financial services.

Figure 15.2 Generic Strategies and Representation²³

4

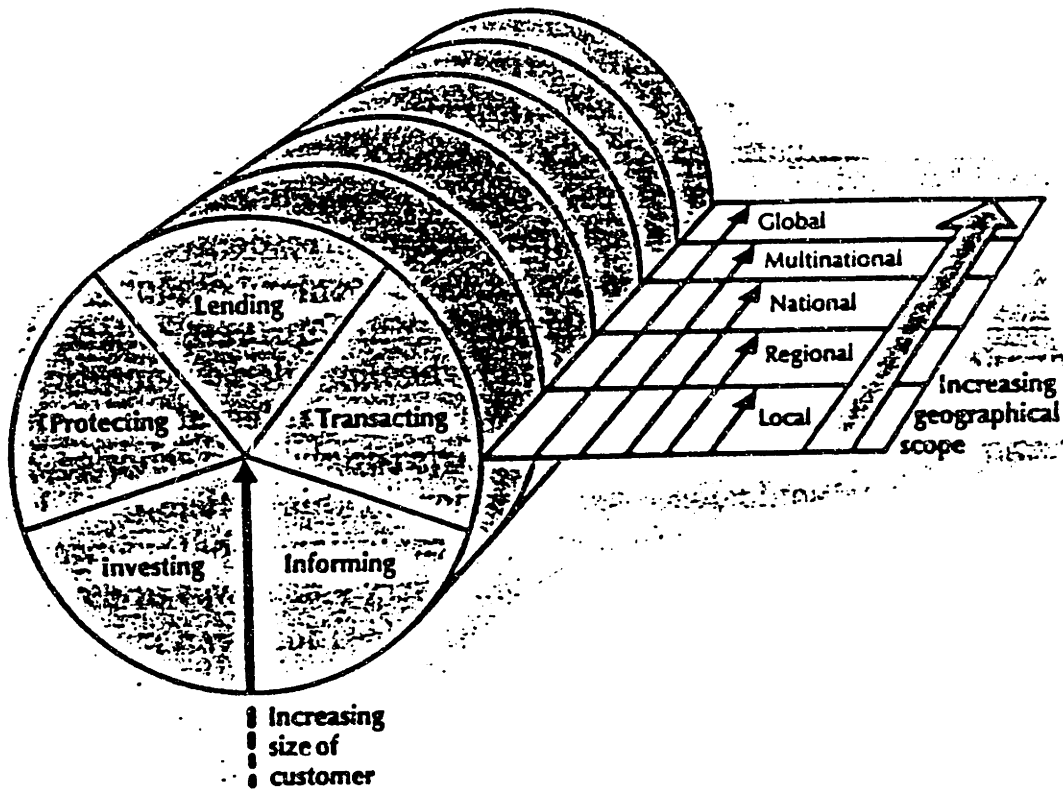
HENRY MINTZBERG

- A. First we shall consider *locating* the core business, which will be shown as a single node—one circle—in a matrix of circles. (Note that we use the word “business” as a substitute for “mission”: the framework is not meant to exclude non-profit organizations.)
- B. Second, we shall consider *distinguishing* the core business, by looking inside that circle.
- C. Third, we shall take up *elaborating* the core business, considering how the circle may be enlarged or developed in various ways.
- D. Fourth, we shall consider *extending* the core business, leading the circle to link up with other circles (other businesses).
- E. Fifth, we shall consider *reconceiving* the (core) business(es), in effect changing or combining the circles.²



²³ From: Mintzberg, Henry. “Generic Strategies: Toward a Comprehensive Framework.” In *Advances in Strategic Management*, ed. Robert Lamb and Paul Shrivastava. 1-67. 5. Greenwich, Connecticut: JAI Press, 1988.

Figure 15.2 Strategy Representation in Financial Services²⁴



²⁴ From: Gonzalez, Maria and Henry Mintzberg. "Visualizing Strategies for Financial Services." McKinsey Quarterly (Number 2 1991): 125-134.

Mintzberg's formulation is important since it provides a useful classification of strategy types and simplifies the visualization of different strategies. It enables managers to systematically consider strategy alternatives, while not constraining them to adopt a specific means to implement the strategy as suggested by more formal techniques. Third, it enables managers to consider the interdependence between the firm and other businesses.

The roles-linkage model has a number of advantages over the above approaches. First, as firm and industry boundaries, and product-market segments are continuously redefined in the 1990s, the central unit of analysis defined as a core business or a firm in traditional schemas becomes increasingly unstable over time, and does not adequately represent the linkages with the environment. Schemas based on these units of analysis are not amenable to systematic description and comparison of business network structures over time. Business segmentation and representation of networks in terms of roles provides an analytically more useful representation of the network.

Second, prior frameworks do not consider the modes of managing interdependence critical in influencing the behaviors of role occupants. While the industry competitive analysis framework begins to address interdependence between the business and its environment, it, like earlier portfolio models, does not systematically consider alternative strategies for managing interdependence across business units or with the environment. The dominant and traditional strategy paradigm for managing interdependence with other actors in the business environment is primarily vertical or horizontal integration through common ownership (Chandler

1962; Porter 1980). As management of interdependence becomes an increasingly strategic issue, the roles-linkage model provides a schema for visualizing and understanding patterns of interdependence across roles.

Third, prior models do not provide a convenient way to represent and analyze the effects of technology on business networks, especially information technology. As illustrated by the case studies, the roles-linkage model provides a useful starting point to consider how technological change can affect both of the elemental units of networks: individual roles and linkages, as well as the network defined by the pattern of roles and linkages.

To summarize, the preliminary roles-linkage model provides a useful schema and tool to researchers and managers for the systematic representation and study of business networks. It enables researchers and managers to focus on how technology interacts with networks by considering the effects of technology on salient constructs of roles, as well as the management of interdependence between roles. It forms a useful starting point for constructing a theory of strategy and structure at the level of the network. However, a number of critical issues must be resolved to make the roles linkage model an effective tool to support theory development and strategy formulation in firms. These issues are considered below.

15.1.3 The Roles-Linkages Model: Difficulties and Limitations

There are several difficulties in implementing and using the current roles-linkage model.

The first difficulty relates to the construction and implementation of the roles-linkage model. Roles and linkages are counter intuitive to many

managers who are used to thinking in terms of businesses, firms and products. The roles-linkage model imposes a rational structure to represent environments, while managers are imperfectly rational and use various approaches to thinking and problem solving (Isenberg 1984; Kotter 1982). As roles are abstract and counterintuitive constructs, it is necessary to refine methods for data collection to enable researchers to efficiently elicit roles and classify linkages. The data collection process for data that sheds light on the level of the network is also expensive and slow.

Another critical issue in the use of the model as a representational tool for research purposes is the design of methods to test the validity of a roles-linkage model. At present the validity of models is contingent on documented examples or expert characterization of specific roles and linkages. Future research will address methods for validating and such large models.

Third, while the roles-linkage approach reduces the complexity of real business networks through abstraction, the network model can still be very large and difficult to interpret. This is clearly illustrated by the model for the health care industry. Tools are necessary to provide the researcher and strategists to consider partial views of the network, and further manage the complexity of roles-linkage model. In addition, tools are necessary to help researchers manage roles linkage data, and analyze models over time. Some extensions for computerizing aspects of model construction and representation are considered in the next section.

Fourth, as identified by Gonzalez (1991), the strategies deployed by organizations can vary with the scale of operations and geographic scope. Hence, differences in geographic scope and scale can define different models

of the business network. For example, an HMO may have fundamentally different ways of managing interdependence between roles depending on whether it targets a local or national market. The issues of consistent models of the environment based on differences in geographical scope or scale is an issue for future study. The two studies developed in this thesis did not account for these differences, and sought only to highlight dominant or emerging patterns of behavior.

Fifth, the model focuses on the exchange of economic exchange across role stakeholders. The model does not simply illustrate direct informational links across role stakeholders when there isn't an economic transaction. For example care providers may send claims to the claims administration role even though there isn't a direct economic transaction across these roles. Hence, it is necessary to also begin to capture other networks that interconnect stakeholders across roles.

Extensions to the roles linkage model to address these issues as well as directions for future research are considered below.

15.2 The Roles-Linkage Model: Extensions and Future Research

15.2.1 Improving the Model Construction Process

The process of creating the health care roles linkage model undertaken in this dissertation was inefficient. Techniques of eliciting the executives' knowledge and experience to identify roles for the roles-linkage representational model require further development.

I am currently refining approaches to roles-linkage definition. Specifically the definition of roles can be triangulated from interviews with managers that

address three questions: the role of the executive in their organization, the key products and services in the market place, and the organizations in the external environment that affect the firm's strategy. As a starting point managers are asked about their role in the organization and how their activity connects with different functions in the marketplace. This is used to identify critical functions in the organization, as well as the knowledge and technological skills required to undertake different roles in the organization. Second, as managers frequently rely on existing models to guide their reasoning, one approach to eliciting roles is to ask them to identify products and services that exist in a market place. The researcher and analyst can then engage the executive in identifying the critical activities required to provide the product or service typically through constructing a value chain. A third basis for identifying roles is to ask the manager to identify the critical organizations in their environment which influence strategy. Collectively these mechanisms can be used to identify areas and actions of importance to a specific organization, as well as the key business roles that define the business network.

The construction of roles requires interviews with executives who manage different types of organizations in a marketplace (e.g insurance executives, physicians and pharmacists). Typically networks were sampled using a snowball sampling strategy that sampled all linkage connected to an actor, and the next actor and so on. Similarly in developing a business network representation, a snowball technique can be used to identify the collection of roles for consideration. However, the researcher must make a judgement of the roles that are important for inclusion in the study. Once the different

roles are identified, their specification can be evaluated by a panel of industry executives.

For undertaking studies of transformation, it is also necessary to identify roles that were previously important in the network, or might be considered to be of importance in the future.

The second part of model construction is the specification of linkages across roles. There are two critical issues here from a data collection perspective. Given the large number of roles and organizations in a business network, data collection and verification can be very expensive. As there are many possible linkages in any network this process must also be made efficient. Second all informants may not know about the entire network. Hence procedures need to be defined for systematically dealing with missing data and integrating the data from multiple informants into a single model. At present two approaches are feasible for data collection linkages. The first is to develop a short form questionnaire which is answered for each linkage. The answers are then analyzed to code the linkage. The second form of data collection is to develop descriptions of each category and ask informants to code different linkages based on these descriptions. The efficiency and reliability of each process needs to be tested.

15.2.2 Computerized Support for Model Construction, Data Management and Analysis

One means of increasing the efficiency of model construction is to develop a decision support tool and software that supports model construction, data

management and analysis. A prototype version of this tool has been developed.

Once roles have been specified, an electronic questionnaire can be implemented for data collection. This can be used to speed up data collection, as well as enable the respondent to visualize and navigate the network.

Second an electronic questionnaire automates the process of transcribing data for analysis. In addition a variety of representation and analysis tools become available.

Because the roles-linkage model can be transformed into an adjacency matrix, the representation can be computerized and manipulated to create different views of the network, and identify patterns and structures in the network. These views include a general environment view as well as firm specific views. The current software also incorporates region specific views.

The software can also incorporate traditional social network analysis procedures to compute indices for network characteristics such as network density, centrality, distances and degree (Knoke and Kuklinski 1982). These indices can be used to systematically characterize and examine the effects of technology on network structure or the pattern of roles and linkages.

Other operations and indices that can be implemented in a computerized roles-linkage model include role aggregation and multiplexity. *Role aggregation* is an operation on the roles-linkage matrix to analyze and identify naturally occurring clusters of linked roles. Using the concept of structural equivalence developed in network analysis, we can identify what are the naturally occurring clustering of roles that makes up either a firm or a network firm as defined by partnerships. Structural equivalence is a network

analysis procedure for grouping together roles to the extent they have common relationships with all other roles in the network [see Burt, Breiger].

As discussed earlier, a single firm may have substantially different role-linkage profiles depending on the geographic scope of operations. The *multiplexity* index can be used to examine the consistency of strategy and linkages across different role-linkage models for geographic segments.

Traditional network analysis algorithms can also be automated to create indices for *euclidean* or the *shortest path distances* in terms of the number of distinct linkages, or intermediate roles between two roles. This can be used to consider the means as well as the capacity of a role to influence actors that occupy other roles. The index can also be used to systematically represent changes in network structure over time.

Computerization can also provide decision support for strategy development. First, a computerized representation of the roles-linkage model is a powerful means of summarizing and conveying information on the business network during the planning process.

Second, by coloring or patterning the roles and linkages we can visually highlight different structures and patterns in the network. Competence enhancing effects can be represented by a denser shading of roles or linkages than competence reducing effects. This can be useful for comparing alternate scenarios. For example, comparisons among different scenarios and networks can be simplified given the adjacency matrix representations of two business networks. Using a simple differencing procedure, a new adjacency matrix can be created that only highlights network differences. This helps focus managerial attention on the patterns of change and areas of transformation

within a business network. In addition, this procedure can be used to highlight which new roles emerge in a business environment and which old roles have become less important.

Finally, the decision support tool can also be used to systematize collection and storage of information on competitors. This can be used to clarify their patterns of roles and linkages.

15.2.3. Roles-Linkage Model: Research Applications

In addition to improving the roles-linkage model through computerization, and improving methods of construction, the model can be used for three basic research purposes.

First, the current study can be extended to other industries and markets to examine how technologies or policies affect the structure and functioning of business networks. Extending the current research on electronic integration through constructing additional case studies of business network transformation will provide a research base for constructing more formal theories of competition in networked markets, and more formalized schemas for strategy formulation. Indeed, as the traditional informational boundaries between market-segments, firms, environments and industries are blurred, the assumptions underlying much of the traditional research in strategy is increasingly obsolete.

A second stream of research can be developed from the roles-linkage model to gain insight into managerial processes of strategy formation. Specifically, are there systematic differences in how managers perceive their environments and use models. Do models enacted by managers vary by

tenure in the industry or position in firms? The roles linkage model can also be a useful tool in assessing and evaluating the shared assumptions of executive teams about their environment.

Third, constructing a roles-linkage model generates hypotheses and is a precursor to systematically measuring market transformations and studying how firms change strategies in markets. Specifically by examining firm performance, the timing of role changes, and other firm characteristics we can examine the success of firm responses to technological discontinuities such as electronic filing in the tax preparation market place. These studies can form the basis for a theory of strategy in business networks.

15.3 Conclusion

The roles-linkage model provides a powerful new schema for researchers and strategists to represent and analyze business networks. The model provides a useful abstraction and typology for simplifying and specifying a business network. As the population of roles is generally less than the population of firms, the network representation of the environment is substantially simplified. Traditional network analysis tools can also be applied to this schema to compute indices that characterize the network, and for its analysis. The model is especially useful for understanding organizational transitions in large scale systems.

The critical review has also identified the limitations of the roles linkage formalization, including inefficiencies in data collection, and analysis. In this chapter I have developed clear proposals to address these limitations as well as a general strategy for applying the roles linkage model to developing a

theory of the interaction between technology, strategy and structure in increasingly networked markets.

To summarize, the roles-linkage model provides a new schema for researchers and strategists to exert the power of the mind over increasingly complex environments and large scale socio-technical systems.

Chapter 16

Conclusions and Managerial Implications

In this study I have developed a preliminary role based theory of how information technology applications transform strategies and structures in business networks. Analysis of the case studies identified information and technology leverage as two distinct dimensions of electronic integration strategies which were applied to transform role provision and the management of interdependence between roles. Specifically, the routinization of information processing activities shifts skill requirements underlying a role, and can alter the population of role providers. New information processing capabilities also enable the customization and specialization of linkages. Information resources allow organizations to extend managerial control across firm boundaries and alter the nature of relations with agents and other entities.

Information and technology leverage also change the pattern of relevant roles and linkages, expanding the business network and enabling firms to coordinate and implement complex strategies that transcend traditional industry boundaries. Specifically, information and information processing become new sources of value in the business network and firms reconfigure to capture and use these resources. These new resources and capabilities also enable complex firm strategies that take advantage of information asymmetries, externalities and product complementarities across markets. Typically, such strategies are implemented through joint ventures or strategic alliances.

Comparison of the descriptive theory developed from the cross case analysis to extant theories of strategy and structure shows that the existing theories provide few guidelines or normative frameworks for information technology-mediated and -coordinated strategies across markets. The comparison of case study findings to the dominant strategy, institutional economics and political economy perspectives show each to be a complementary perspective that provides insight into the motivation and use of electronic integration strategies. Electronic integration can be applied by firms in different ways for competitive advantage, in altering control and managing interdependence, and to gain authority and stabilize resource flows in complex organizational networks. However, prior theories are limited in their ability to provide guidelines on how firms should organize to take advantage of electronic integration strategies. Specifically, they provide few guidelines for how firms should position in markets, organize internally, and manage interdependence with external organizations.

An emergent organizing principle is to organize around the core competence of the firm. Electronic integration in organizations enhances the core competencies of firms by providing the information and processing capabilities to facilitate organizational learning. Second, technology provides the coordination infrastructure to leverage the core competence. Indeed alliances and partnership modes of coordination and influence are increasingly the means by which firms translate their core competence into products and services of value. Third, as illustrated in the cases studies, the management of information technology itself becomes a core competence or critical importance to firms in the network.

As firms develop complex organizational networks, and execute strategies across different industries, new approaches to represent firm strategies and structures in markets are required for business visualization. A second contribution of this thesis, in addition to the preliminary theory, is the specification of the roles-linkage model as a representative schema. The roles-linkage approach focuses managerial and research attention on the salient constructs of the technology applied to role provision and means of managing interdependence between roles. The schema is also efficient as a means of visualizing a firm's strategy in the business network as well as simplifying the analysis of organizational networks.

Third, the critical analysis of the roles-linkage model identified process guidelines for creating role-linkage representations and decision support systems to help managers analyze their environment. In addition some process guidelines were identified to increase the efficiency of researching business network transformations. The analysis also identified ways of using the roles-linkage model as a precursor to developing detailed measurements of network transformations and firm strategies. Finally the two case studies developed in this thesis add to the rich descriptions of the use of technology in shaping networks.

Electronic integration by altering the business network also gives rise to the following management imperatives:

Rethink the Core Business

Electronic integration by radically transforming the business network forces management to reconsider the business scope and position of the firm in the

network. Specifically it is necessary to identify which roles show promise for growth, and how technology will alter the provision of the role. Second, it is necessary to align the organization's objectives with its capability to provide specific roles. In addition management must define how the core business will be integrated in to a wider systems of roles and linkages. As some roles become less profitable in the network, firms will have to reposition in the business network.

Redefine the Business and Organizational Network

Electronic integration provides managers with new degrees of freedom in coordinating strategies across markets and designing relations across organizational boundaries. Managers must redesign the interface between an individual firm and other organizations to fit new governance requirements. New information technology resources and electronic integration are instrumental in creating or redefining organizational and business networks to assure stability and access to valuable network resources.

Redesign systems to support Managerial Analysis of Networks

Both case studies illustrated the increasing complexity of the business network. Representational and analytic tools need to be developed to support managerial decision making in networks. I propose that decision support systems incorporating the roles linkage model are a useful starting point in this effort.

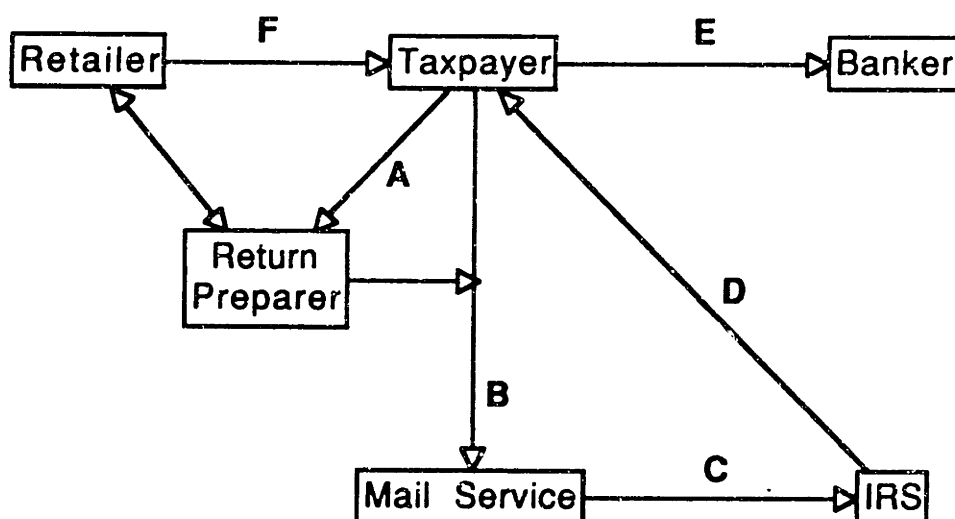
In summary, the contributions of this study are fourfold: case studies that provide a rich description of technology and transformations in business networks; a theory relating the use of information technology and network

transformation; a representational schema for the analysis of business networks, and a clarification of issues related to data collection and theory construction at the network level.

Appendix 1

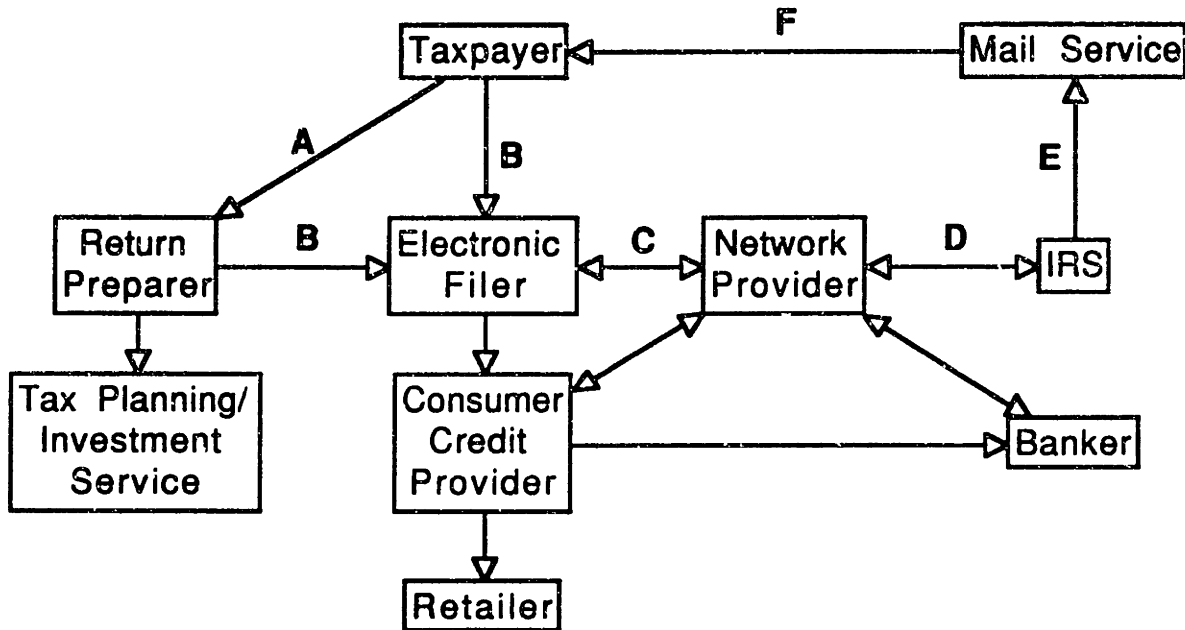
The purpose of this appendix is to illustrate some of the key process relations in the tax preparations and health care markets. This is to simplify and clarify the roles linkage models, and to illustrate the prior descriptions in the case studies.

The Tax Preparation Market Pre-Electronic Filing



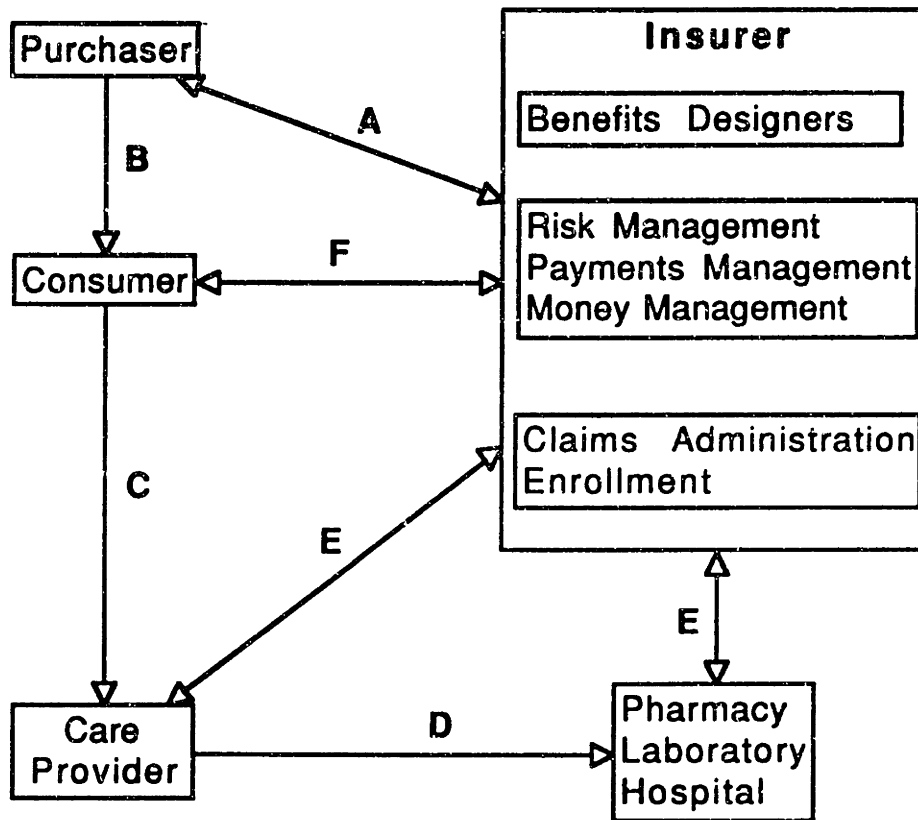
In the market the stakeholder in the tax payer role uses a return preparer (link A) or files a self prepared tax return to the IRS using the mail services (links B and C). The IRS processes the return and sends a check to the tax payer through the mail service (link D). The check is cashed or saved at the bank (link E). If cashed the tax payer can consume the refund at a retail store (F). The return preparer may have an agreement with the retailer to lease space to provide tax preparation services.

The Tax Preparation Market after Electronic Filing



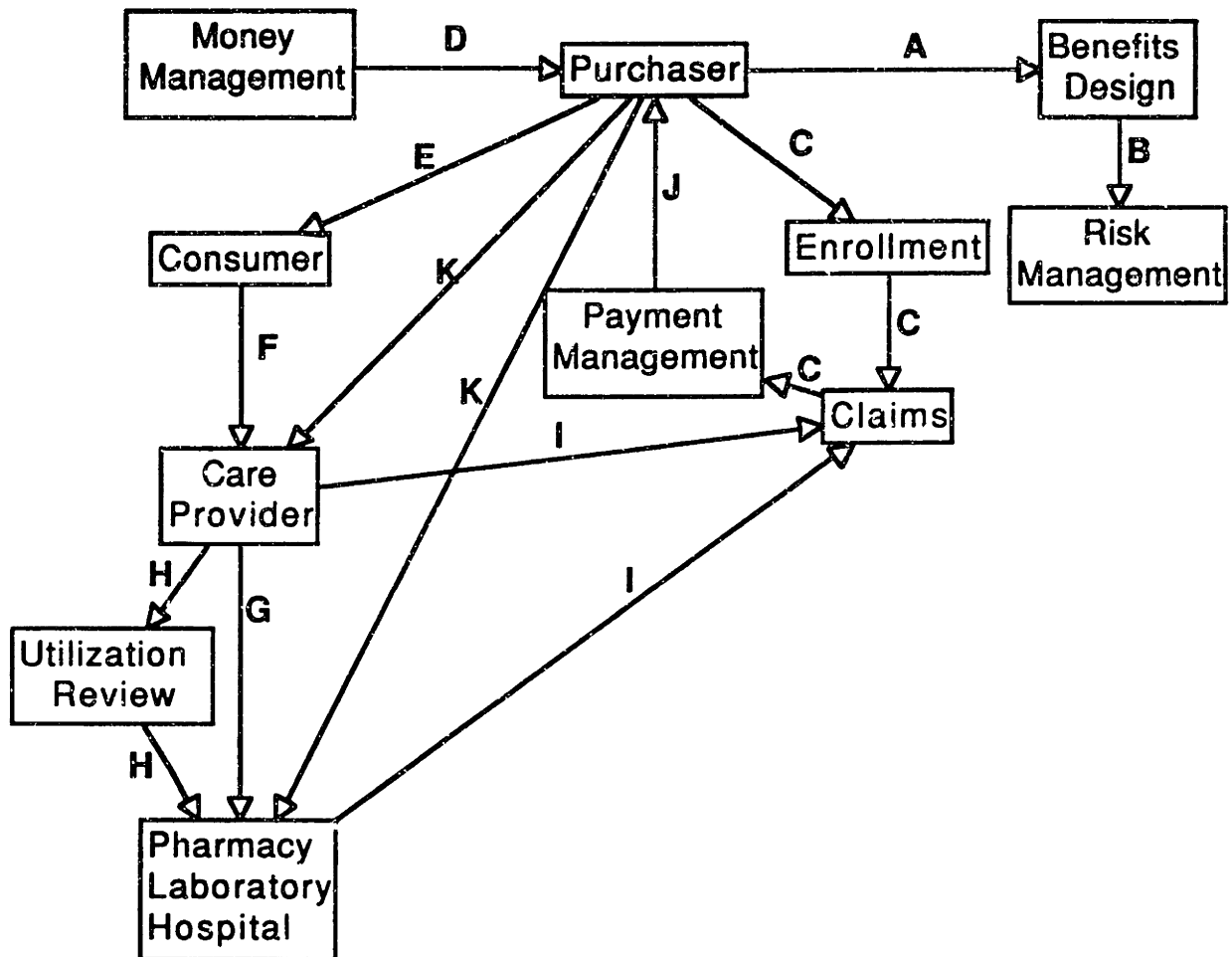
The tax payer uses the return preparer or self prepares the tax return (link A). The return is then filed using an electronic filing service by the return preparer or a specialized service. This is typically done using a value added network provider or the telephone networks (links C and D). When the return is filed the IRS provides confirmation that the tax payer is owed a refund. The IRS can mail the refund to the tax payer (links E and F). Alternatively they can electronically transfer the refund over the network to the banks or the credit providers. This money is then used by the tax payer for retail purchases. In addition the computerization of return preparation leads to the leverage of tax information to provide value added tax planning and investment services to the tax payer.

The Health Care Market - Third Party Payor Model



In the pre-managed care, the third party payor model of health care can be illustrated in the simplified diagram above. The purchaser of health care - usually an employer would develop a benefits package in consultation with the insurer, or using inhouse capabilities for benefits design. The insurer would then offer a benefits package and charge premiums to the purchaser (link A). The benefits plan provided by the employer to the employee (link B) permit employees to enroll in the insurance plan. If the consumer uses physician care or other medical resources (links C and D) such as pharmacies, labs and hospitals then claims are submitted to the insurance firms by care and resource providers (links E) or by the consumer (link F) for reimbursement. As the costs of care are borne by a third party and not the consumer, the consumer has incentives to overconsume care and the provider to over charge for care.

Third Party Payors with Utilization Review



As illustrated in the roles linkage diagram earlier the shift toward managed care has made the business network significantly more complex. For illustrative purposes two small changes are considered to the traditional third party payor model: these are a shift to self-insurance by employers and the addition of utilization review.

Here the purchaser or employer typically hires a consultant to devise a benefits plan that evaluates and minimizes risk, while providing health coverage (link A and B). The health plan is implemented and the purchaser implements enrollment, claims administration and payments management programs inhouse or contracts to specialized services (links C and J). Given self-insurance the premiums not paid to the insurance firm are directly managed by the purchaser firm or through contract with a asset management firm (link D).

The employee or health care consumer is then enrolled in the plan (link E). If he or she visits a care provider and other services, claims are generated and are submitted to the claims administrators (link I). Valid claims are

reimbursed through payments management and from the purchasers funds (link J and K). Both the care provider and subsidiary services are reviewed by utilization reviewers (link H) to see that medical resources are not overutilized.

In summary the health care system is undergoing major change. Roles are disaggregating and firms are reconfiguring the activities they undertake and the modes of managing these new configurations.

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