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LINKING ORGANIZATIONAL PERFORMANCE TO INTERORGANIZATIONAL SYSTEMS: IOS NETWORKS AND CAPABILITIES

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Introduction

The term “interorganizational systems” (IOSs) first appeared in the 1980s. It refers to “automated information systems which are shared by two or more organizations” (Cash & Konsynski, 1985: 134), for example, American Airlines’ SABRE reservation system, American Hospital Supply’s ASAP system, First Boston’s Shelternet mortgage system. In the broadest sense, IOSs consist of computers and communications infrastructure that permit the sharing of task performances between a company and its customers, suppliers as well as other partners, such as systems for making reservations or for ordering supplies or for joint decision-making or for product co-design or for knowledge sharing. IOSs have been regarded as strategic information systems used to support or shape an organization’s competitive advantage (Rackoff et al., 1985). They not only allow a company to produce goods and services at a lower cost and higher speed than its competitors, but also can reduce a company’s searching cost, add unique values to its product and increase its customer’s switching cost (Johnston & Vitale, 1988).

However, the proliferation of alliances during the past decade has changed the pattern of competition. The traditional role of IOSs needs to be redefined. Companies increasingly collaborate with their customers, suppliers and other partners, and form constellations of allied firms. Contrary to the traditional view of economics which holds that collaboration leads to a suppression of competition, these constellations become a new force of competition (Gomes-Casseres, 1996). They not only tend to facilitate new entries and increase barriers to exit, but also enable rapid assembly of the complementary capabilities of the allied firms and speed up new product introductions (Gomes-Casseres, 1996). Consequently, in addition to the bargaining power and comparative efficiency (Johnston & Vitale, 1988; Bakos and Treacy, 1986; Porter, 1980)—the traditional sources of competitive advantage, effective collaboration between allied firms has become another important source of competitive advantage.

The main purpose of this dissertation is to study the use and impact of IOSs in the emerging collaborative commerce. It does so by exploring the following research questions:

- What are the key IOS factors that impact a firm’s (an IOS user’s) competitive advantage?
- In what way do these factors impact a firm’s (an IOS user’s) competitive advantage?
 - How do these factors influence a firm’s bargaining power?
 - How do these factors influence a firm’s comparative efficiency?
 - How do these factors influence a firm’s collaboration with its partners?

The rest of this paper is organized as follows: section 2 presents the theoretical background for this dissertation study; section 3 discusses the hypothesized model; section 4 introduces the methodology; section 5 presents the contributions and implications of the study.

Theoretical Background

This section reviews a series of theories and frameworks of social networks and competitive advantage. These theories and frameworks provide a foundation for the development of the hypothesized model in this dissertation study.

Social Network Theories

The Structural Hole Theory (Burt, 1992)

The structural hole theory defines structural holes as the sparse regions in a network. The theory proposes that structural holes present opportunities for brokering information flows among firms. These opportunities have economic payoffs because the broker's information advantage creates the potential for arbitrage in markets for goods and services. So a firm that positions itself in the structural holes between or within dense regions of relationships is able to obtain higher economic returns than firms that do not.

The Social Embeddedness Theory (Uzzi, 1997; Granovetter, 1982)

The social embeddedness theory emphasizes that economic action is embedded in networks of relations. The theory distinguishes two forms of exchange: "arm's length ties" and "embedded ties." Arm's length ties refer to "one-shot deals" or "market relationships," while embedded ties are "close or special relationships" characterized by reciprocity and repeated interactions between exchange partners. The theory proposes that in an embedded tie, trust acts as the primary governance structure, while calculative risk and monitoring systems play a secondary role. In an embedded tie, information transfer is more fine-grained, tacit, and holistic than the typical price data of pure market exchanges, and joint problem-solving arrangements promote long-term cooperation between exchange partners rather than the mere pursuit of one party's self-interest. Thus, organizational performance increases with the use of embedded ties to link to network partners. Yet there is a threshold to the positive effects of an organization's embedded ties. Beyond the threshold, embeddedness can derail economic performance by making the organization vulnerable to exogenous shocks or insulating the organization from information that exists beyond its network. As a consequence, network structures that integrate arm's length ties and embedded ties optimize an organization's performance potential, while network structures comprising only arm's length ties or embedded ties decrease organizational performance potential.

A Framework of Network Structure and Power Use (Brass and Burkhardt, 1993)

The power behavior-structure framework contends that an individual's structural position in a network indicates the others' perception of the individual's power, while an individual, through the use of behavior tactics, may either reinforce an advantageous position or actively seek to change a disadvantageous position in the network. The relationship between structure and behavior is that structure emerges from behavior, while behavior is shaped by structure. Individuals in central network positions have greater access to and potential control over relevant resources such as information. Behavior tactics of power use can be grouped into six categories: assertiveness, ingratiation, rationality, exchange, upward appeal, and coalition formation. Assertiveness includes such influence tactics as demanding compliance, ordering, and setting deadlines, as well as nagging and expressing anger. Ingratiation is associated with such behaviors as praising, politely asking, acting humble, making the others feel important, and acting friendly. The rationality tactic consists of using reason, logic, and compromise in attempting to influence others. The exchange tactic refers to such behavior as offering to help others in exchange for reciprocal favors. Upward appeal is indicated by behaviors to gain support from superiors in an organization. Coalition formation refers to attempts to build alliances with others.

Competitive Advantage Frameworks

The Relational View of Competitive Advantage (Dyer and Singh, 1998)

The relational view points out that competition between single firms, although still common, is becoming less universal, as networks of allied firms have begun to compete against each other. The relational view considers interfirm network as the unit of analysis. It points out that a firm's critical resources may span firm boundaries and may be embedded in interfirm resources and routines. The relational view proposes that networks of firms, through investments in relation-specific assets, through fostering knowledge-sharing routines and increasing partner-specific absorptive capacity and expertise co-specialization, through combining complementary resources or capabilities, and through employing effective governance, can achieve effective collaboration and thus achieve competitive advantage.

The Industry Structure View of Competitive Advantage (Johnston and Vitale, 1988; Bakos and Treacy, 1986; Porter, 1980)

The industry structure view contends that competitive advantage stems fundamentally from two factors: comparative efficiency and bargaining power. Comparative efficiency allows an organization to produce its goods or services more cheaply than its competitors. Bargaining power allows a firm to resolve bargaining situations with its customers and suppliers to its own advantage. The strength of these factors is determined by even more fundamental issues—comparative efficiency including both internal efficiency and interorganizational efficiency, and bargaining power including unique product features, switching costs, and search-related costs.

Hypothesis Development

In the IOS literature, different tactics of power use and trust have been identified as critical factors in influencing the use of IOSs (such as EDI) and the ultimate organizational performance of the IOS users (Hart and Saunders, 1997). Besides behavioral factors, IT infrastructure capabilities have also been suggested as critical to a firm’s competitiveness (Weill, et al., 2002; Broadbent, et al., 1999). Furthermore, studies in interfirm networks have emphasized that a firm’s competitiveness not only rests on its internal resources and capabilities, but increasingly comes from its external resources and capabilities derived from a network in which the firm participates (Dyer and Singh, 1998). The external resources to which a firm may access can be manifested through the firm’s network position.

Integrating these separate views, this dissertation study proposes that (1) IOS (network) structure directly impacts organizational performance; (2) IOS capabilities directly impact organizational performance; (3) behavioral tactics in the use of IOS directly impact organizational performance; (4) while a firm’s IOS structure evolves from its IOS capabilities, capabilities are constrained by structure; thus the interaction between capabilities and structure also impacts organizational performance; (5) while a firm’s IOS structure emerges from its behaviors to use the IOS, behaviors are shaped by structure, thus the interaction between structure and behaviors also impacts organizational performance; (6) organizational performance can be measured by three variables: bargaining power, comparative efficiency, and collaborative effectiveness; these variables are positively related to a firm’s competitive advantage. Figure 1 summarizes the proposed relationships between IOSs and organizational performance.

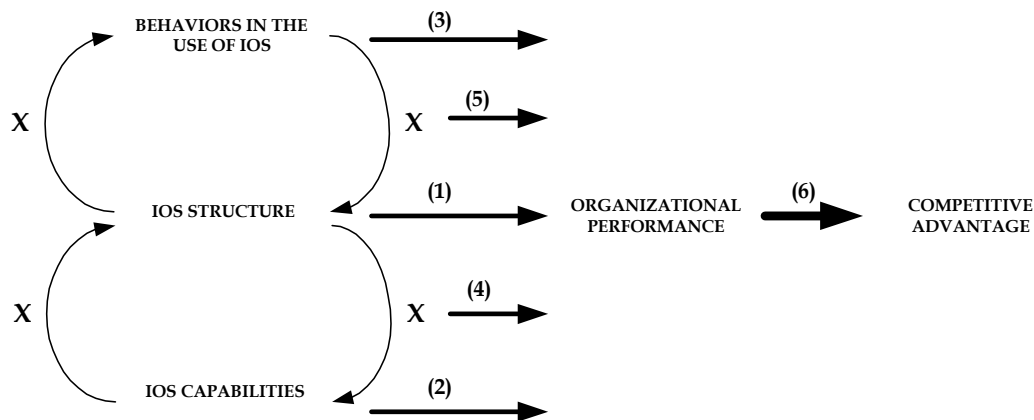


Figure 1. The Proposed Relationships between IOSs and Organizational Performance

IOS Structure

Keen (1991) introduces the idea of achieving competitive advantage via effective positioning the *reach* and *range* of a firm’s IT platform. He defines *reach* as the locations a firm’s IT is capable of linking, and *range* as the degree to which information can be directly and automatically shared across systems and services. This study adapts these two terms to advance the idea that a firm’s IOS *reach* and *range* determine its IOS structure.

IOS *reach* refers to the relationships a firm's IOS platform is capable of linking. Customers, suppliers, complementors and intermediaries (Keen, 2001) represent four basic types of relationships a firm's IOSs can connect. They form a company's value network by bringing different values, opportunities, capabilities and resources to a firm (Keen, 2001). IOS *reach* is associated with four measures: the number of IOS relationships, the in-degree centrality, the closeness centrality, and the betweenness centrality. Based on social network theories, a firm, whose IOSs can reach a wide variety of relationships, is more likely to occupy a central position in the network and obtain high economic returns by leveraging a variety of information and capabilities that could not be obtained by the firms at peripheral positions. The in-degree centrality indicates the alternative partners available to a focal firm and is calculated as the number of other firms who choose the focal firm. The closeness centrality indicates the a focal firm's access to others (network resources) and is calculated by summing the lengths of the shortest paths from the focal firm to all others. The betweenness centrality indicates a focal firm's control over others and is computed as the extent to which a focal firm falls between pairs of others on the shortest path connecting the pairs.

H1a: The number of IOS relationships, the in-degree centrality, the closeness centrality, and the betweenness centrality in an IOS network are positively related to organizational performance (bargaining power, comparative efficiency, and collaborative effectiveness).

IOS *range* refers to the types of transactional activities a firm's IOS platform is capable of supporting. There are three distinct types of interfirm transactional activities: discrete market transactions, recurrent contracting transactions, and relational contracting activities (Ring and Van De Ven, 1992). The characteristics of these interfirm activities also indicate the strength of the relationships (tie strength) between a firm and its IOS partners. A firm engaging in relational activities with its IOS partners tends to have strong ties with those partners due to long-term and repeated interactions; a firm engaging in repeated transactions would have relatively shorter and weaker ties with its partners due to less interactions; while a firm engaging in market transactions with its IOS partners tends to have the shortest and weakest ties with those partners due to the one-time deals and non-repeated interactions. Based on the social embeddedness theory, strong ties allow a firm to exploit information and capabilities of its partners deeply at a low cost; but the positive effects of a firm's embeddedness in its IOS network has a threshold, beyond which the firm's performance tends to decrease. The optimal organizational performance can be achieved by integrating a wide range of different types of transactional activities, rather than engaging in merely relational activities or recurrent transactions or market transactions.

H1b: IOS range is positively related to organizational performance (bargaining power, comparative efficiency, and collaborative effectiveness).

H1c: The tie strength in an IOS network is nonlinearly related to organizational performance (bargaining power, comparative efficiency, and collaborative effectiveness).

IOS Capabilities

IOS capabilities refer to IT infrastructure capabilities that support cross-boundary organizational activities: primarily hardware platforms, software platforms, communications technology, middleware, groupware and other capabilities providing shared services to a range of applications and common mechanisms for handling different data types (Broadbent et al., 1999). IOS capabilities are related to two factors: IOS sophistication and IOS functionality.

IOS Sophistication

IOS sophistication indicates the level of complexity, experiences, and skills of a firm's IOS capabilities. It is a combination of the level of process management (infrastructure applications that support production and inventory planning, marketing and sales, product design as well as other functional areas, e.g., ERP applications, CRM applications, SCM applications), the level of content management (e.g., database management, knowledge management), the level of communications and network capabilities (e.g., broadband, LAN, WAN, EDI links, groupware), the level of security and risk safeguards (e.g., data protection, hacker protection, access control, disaster planning, firewall on secure gateway services), the level of channel management (e.g., electronic funds transfer/point of sales, kiosks, Websites, call centers, interactive voice response, mobile computing via dial up or wireless networks), the level of IOS training and personnel expertise, and the level of IOS standards (e.g., firm-specific standards, industry-specific standards) (Weill, et al., 2002). A high level of IOS sophistication allows a firm to link to various types of partners with different IT capabilities, different formats or proprietary software and hardware, provide advanced functionality and process support, and impose high levels of control.

H2a: The level of IOS sophistication is positively related to organizational performance (bargaining power, comparative efficiency, and collaborative effectiveness).

IOS Functionality

IOS provides three distinct levels of functionality: simple data transmission, data access, and access to application (Upton and McAfee, 1996). Data transmission is simply sending a packet of information, such as e-mails or purchasing orders, from one to another. Data access capabilities allow the network members to share common pools of information in more sophisticated ways, such as by creating bulletin boards and virtual file cabinets that authorized users can open, than simple data transmission. Capabilities of access to application allow the authorized users to see and use the programs resident on a given computer whether they are on-site or far away. IOS functionality of data transmission, data access and application access indicates an increasing level of IOS capabilities, and an increasing support for the less structured knowledge-sharing and expertise co-specialization between the IOS partners.

H2b: The level of IOS functionality is positively related to organizational performance (bargaining power, comparative efficiency, and collaborative effectiveness).

Behaviors in the Use of IOS

Power and trust play a critical role in the use of IOSs (Hart and Saunders, 1997). Power can be exercised in different ways, including assertiveness, ingratiation, rationality, exchange, and alliance formation (Brass and Burkhardt, 1993). Trust is indicated by a firm's behavioral attempts to place its willingness and confidence in the others' goodwill and competence to fulfill a delegated transaction (Mayer, Davis and Schoorman, 1995). Different behavioral tactics of power use and trust not only influence a firm's relationships with its IOS partners, but also a firm's ability to access partners' resources.

H3: The use of behavioral tactics in an IOS network is positively related to organizational performance (bargaining power, comparative efficiency, and collaborative effectiveness).

The Relationship between IOS Structure and IOS Capabilities

A firm that can leverage its structural position in an IOS network to enhance its IOS capabilities, and use its IOS capabilities to reinforce an advantageous network position or change a disadvantageous position, is more likely to achieve competitive advantage.

H4: The interaction between IOS structure and IOS capabilities is positively related to organizational performance (bargaining power, comparative efficiency, and collaborative effectiveness).

The Relationship between IOS Structure and Behaviors in the Use of IOS

A firm that can develop appropriate behavioral tactics based on the firm's network position, and effectively use these tactics to reinforce a favorable network position or change an unfavorable position, is more likely to access partners' resources such as information.

H5: The interaction between IOS structure and behavior tactics in the use of IOS is positively related to organizational performance (bargaining power, comparative efficiency, and collaborative effectiveness).

Competitive Advantage from IOSs

A firm's competitive advantage primarily comes from three sources: the bargaining power of the firm, the comparative efficiency of the firm (Johnston and Vitale, 1988; Bakos and Treacy, 1986; Porter, 1980), and the collaborative effectiveness between the firm and its partners (Dyer and Singh, 1998).

- H6a: The bargaining power of a firm is positively related to its competitive advantage.
- H6b: The comparative efficiency of a firm is positively related to its competitive advantage.
- H6c: The collaborative effectiveness between a firm and its partners is positively related to its competitive advantage.

The hypothesized model is summarized in Figure 2.

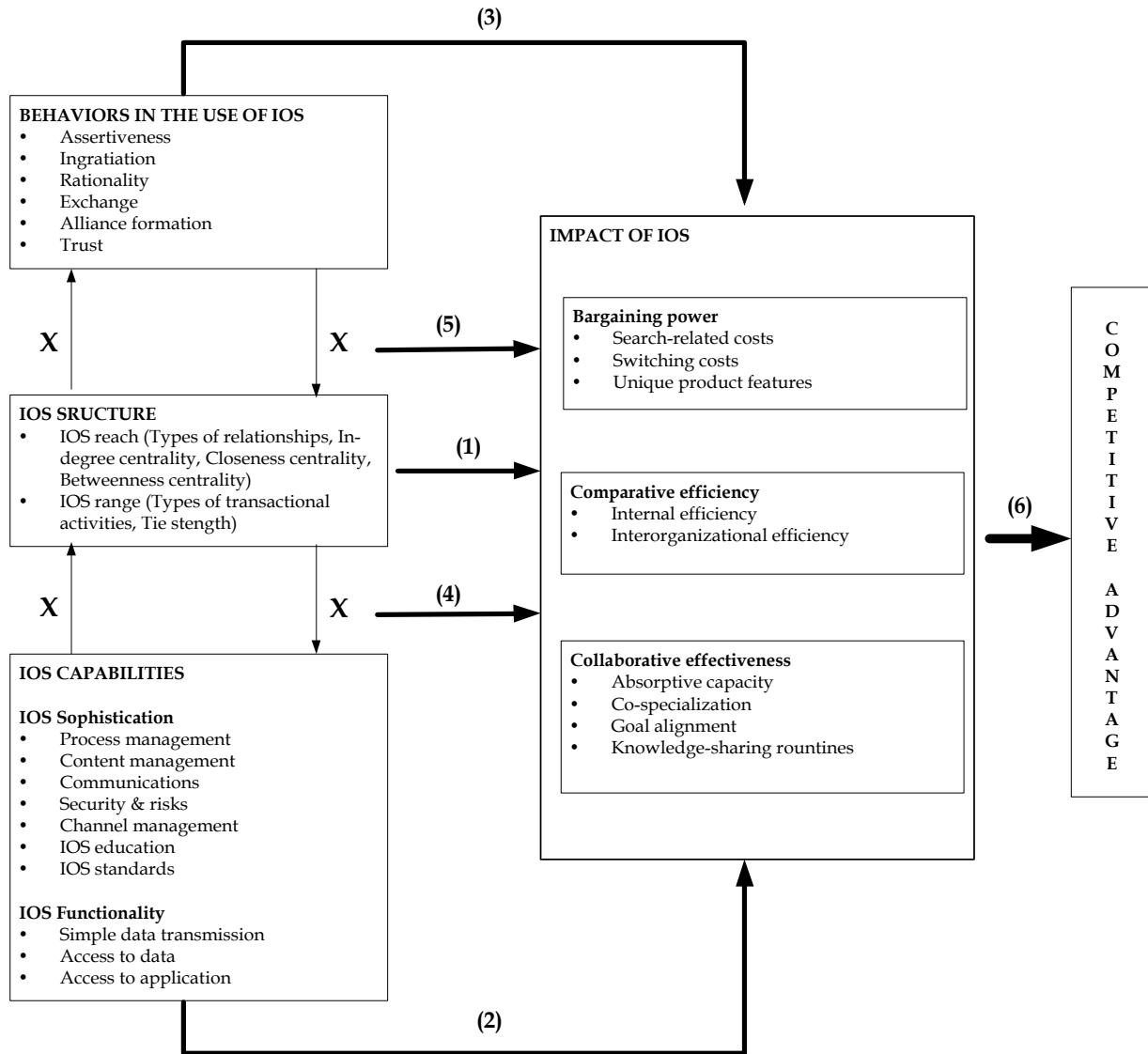


Figure 2. The Hypothesized Model of IOSs and Organizational Performance

Methodology

Case study and questionnaire surveys are being considered as the potential methods for empirical investigation. A survey instrument is under development. Potential subjects will be drawn from firms residing in an IOS network.

Contributions and Implications

The contributions and implications of this study can be several folds. First, by adding a dimension of collaborative effectiveness, the study provides a comprehensive view of the IOS's role in achieving a firm's competitive advantage. Second, it adds depth to both theoretical and empirical understandings of the use and impact of interorganizational systems. Third, it introduces social network theories to study IOS networks and provides practical guidance to enable a firm to strategically position among and within constellations of allied firms with the use of IOS. Fourth, it also offers practical guidance regarding the strategic use of IOSs to help achieve a firm's competitiveness.

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