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## 128. A Theoretical and Strategic Framework for Information Systems Adoption in Supply Chain Management

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### Abstract

*Data, information and knowledge are critical assets to the performance of logistics and supply chain management (SCM), because they provide the basis upon which management can plan logistics operations, organize logistics and supply chain (SC) processes, coordinate and communicate with business partners, conduct functional logistics activities, and perform managerial control of physical flow of goods, information exchange and sharing among SC partners. In this paper, we firstly discuss the theories related to IS/IT adoption, and then we discuss a strategic framework and finally, strategies for IS/IT adoption in SCM context are provided.*

**Keywords:** Information Systems, Adoption, Strategies, Supply Chain Management

### Introduction

It has been evident that information systems (IS) are the effective and efficient means to manage those critical assets, and to provide sustainable competitive advantages, such as IS in financial services, banking and airlines and manufacturers (Clemons & Row, 1991). Organizational and SC capabilities relating to IS/IT have also regarded as key strategic resources, knowledge and expertise in managing IS/IT capabilities and effective IS/IT adoption is now thought to be among the most valuable and essential SCM resources.

However, the interwoven relationships between IS/IT and SCM and research on IS/IT adoption in SCM cannot be simply delineated unless an explicit articulation is provided. In this paper, we firstly discuss the theories related to IS/IT adoption, and then discuss a strategic framework and strategies for IS/IT adoption in SCM context are provided.

### IS/IT Adoption for SCM

The strategic importance of IS/IT introduction in SCM addresses that IS/IT adoption should be carefully planned with SC partners to guarantee a successful implementation of SCM system. In this section, we first present the theories underpinning the IS/IT adoption in SCM context, then we discuss the likely strategies for guiding SC organization to implement SCM system.

### Theories for IS/IT adoption

A literature review reveals that four theories - resource-based view, relational views, transaction cost theory, resource dependence theory provide theoretical foundations for organizational IS/IT adoption in SCM context. We do not attempt to give an exhaustive

presentation of existing theories due to space constraint, but the most influential and deployed theories are included.

From six theoretical attributes, Table 1 concisely presents the review results of the theoretical foundation of interorganizational relationships (IOR) and SCM system related to the technology and IS/IT adoption in the prior studies. Adoption is defined as the development of the “first” successful IS/IT using a new information-process technology in organizational process or products (Agarwal, et al., 1997; Rogers, 1983, 1995). In Table 1, six theoretical attributes are defined as: *unit of analysis* refers to the level of theory application to a specific social unit for analytic interpretation; the *core concepts of the theory* specifies the conceptual contributions of a theory; and *managing IOR* identifies the functions and influences of the core concepts on the IOR (e.g., partner relationships in SCM setting); the *normative consequence* refers to the anticipated outcomes of the theory when applied to IOR, and the *role of IT/IOS* articulates the functionalities of adopted IS/IT in manifesting IOR and partnerships.

#### ***Resource-based view and transaction cost theory***

Resource-based view is regarded as the theoretical foundation for organizational resource utilization. An organization or firm is a bundle of asserts (resources) and capabilities, and the firm’s competitive advantage is derived from the possession of unique strategic resources and capabilities. These resources are: value, rareness, imperfect imitability and in substitutability (Barney, 1991; Wernerfelt, 1984). In this vein, organizational IS/IT adoption is viewed as a strategic investment of organizational capability of utilizing information resources, and leverages the value of information to differentiate the firm’s competitive advantages and uniqueness, and establishes organizational IS/IT capability. Previous studies show that IT is deployed to develop organizational IS to mainly manipulate organizational information and operational effectiveness (Mata, et al., 1995; Santhanam & Hartono, 2003).

Transaction cost theory mainly focuses on the market governance structures of supplying relationships (Williamson, 1981, 1985). The core concept is that in a perfect market, a firm will optimize its supply of resources or products from specialized suppliers rather than make it on its own capability. Firms engage in repeated and contract-based transactions with suppliers – hierarchical relationships arrangement. In cases where the resources or products are highly supplier specific, time specific, and in a complex nature, the hierarchy relationships are the appropriate coordination structure. The transaction costs of managing the relationships and interactions with the suppliers, including searching, negotiating and monitoring execution of the transactions are significantly economic valuable. By reducing the transaction costs, IS/IT adoption and deployment, especially SCM system adoption, allow high level of coordination, increase the value of coordinated resources through economies of scale and scope, and manage relationships by vertical integration (Clemons & Row, 1991; Johnston & Lawrence, 1988; Malone, et al., 1987) and electronic or virtual hierarchies (Holland, 1995).

Resource-based view and transaction cost theory provide sound foundation for SCM system. According to these theories, ones can be predicted that adoption and diffusion of IS/IT in SCM context can optimize a firm’s internal and arm’s-length market resources, and integrate vertical business operations with the firm’s suppliers at lower transaction costs and higher efficiency. However, the theories mainly focus on the organizational resource utilization rather than IOR, and more interfirm coordination rather than SC partners’ cooperation and resource sharing. Thus, the vertical integration or virtual hierarchy is a focal firm specific,

economic oriented and contract-based relationship; and the relationship may suffer from long-term instability when economic and market mechanism changes and increasing transaction risks (Dyer, 1997; Premkumar & Ramamurthy, 1995).

### ***Relational view and resource dependence theory***

Evidenced by the origin of critical resources spanning a firm's boundaries, relational view offers a theoretical understanding of the sources of interorganizational competitive advantage from interorganizational alliances – SC partnerships or IOR (Dyer & Singh, 1998; Oliver, 1990). Relationship view asserts that SC competitive advantage comes from: (1) the relation-specific assets of IOR; (2) substantial knowledge exchange routines, joint learning and partner-specific absorptive capabilities; (3) the synergistic effect of the endowments of complimentary and distinctive resources and capabilities among SC partners; (4) ability to employ informal self-enforcement relationship governance mechanism (Dyer & Singh, 1998; Kanter, 1994; Zhara & George, 2002). Relational view provides sound focuses on IOR, emphasizes the information and knowledge sharing routines.

In line with the social exchange theory (Benson, 1975; Blau, 1964; Emerson, 1962), Pfeffer and Salancik (1978) postulated a resource dependence theory. It defines that resource dependence is based on an organization's ability to (1) control resources needed by other firms, and (2) reduce their dependence on others for resources. That is, an organization must gain control over those resources that are critical to its performance and activities, and reduce the uncertainty in the acquisition of the resources.

Much research has been conducted in the perspective of resource dependence in IOR (Gaski & Nevin, 1985; Oliver, 1990; Provan & Skinner, 1989). Organizational power – a firm's capacity to control (potential power) and the actual act of control (exercised power), the impact of an organization's perception of dependence on its partners, have been intensively studied to reveal their influence on IOR in a social-political structure of IOR. In addition, in a social political process perspective, organizational transaction climate in four dimensions of goal compatibility, domain consensus, evaluation of accomplishment, and norms of exchange has been made significant contributions to understanding of environmental influence of IOR. It is found that a favourable transaction climate results more cooperation and better information flows and decision making on SC transactions (Williamson, 1975).

Comparing with the resource-based view and transaction cost theory, relational view and resource dependence theory give much attention on external resources and collaboration. Relational view focuses on an investment of fair relation-specific assets, development and governance of the interdependence routines of collaborations for SC unique resources and capabilities; while resource dependence theory gives much effort on asymmetric resource distributions in social and political settings, and how a powerful organization can employ the dependency (or network ties, position) of others to accomplish its political, economic and social exchange objectives. Therefore, relational view is a trust based mode of IOR, and resource dependence theory can be regarded as a power based mode of IOR.

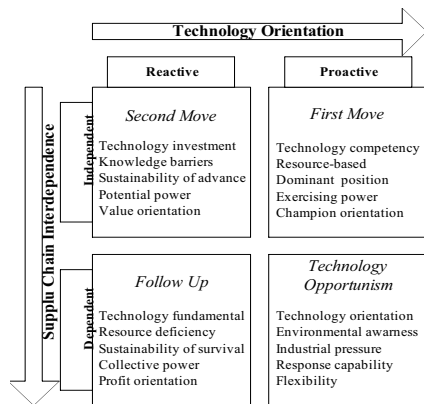
The organization may force its dependent SC partners to adopt business process or innovative IS/IT, such as SCM system, that serve mainly its own interests, while these resource dependent SC partners may have to comply with the mandatory demands from the organization to secure their own business transactions, relations and survival (Pfeffer & Salancik, 1978). Here, the coercive power is defined as the formal and informal pressures

exerted on SC partners by the focal organization (e.g., supplier, retailer or parental corporation, etc) in SC partnerships.

### Strategic framework of IS/IT adoption in SCM

On the basis of prior discussion of the theoretical foundations for IS/IT adoption, as well as the nature of SCM context, we developed a strategic framework to specify the typical strategies for IS/IT adoption with considerations from focal organizational technology orientation and IOR perspectives.

Figure 1. Strategic Framework of IS/IT Adoption in SCM Context



Within the framework, the horizontal dimension - Technology Orientation refers to organizational and interorganizational technology capabilities of conscious initiation of IS/IT adoption, and through assimilation of the system or technology, to develop products, services and operation process, and contribute SC competitiveness and values. Facing an innovative and radical IS/IT, the focal SC organization has two broad rational behaviour approaches: proactive and reactive. Proactive approach refers to those organizational behaviours: hold positive attitude toward IS/IT, motivated by IS/IT adoption opportunities, devote resources to understand, analyze, evaluate and be willing to initiate IS/IT adoption. On the other hand, the reactive approach refers to those organizational behaviours: show less interest in new IS/IT initially, hold back toward the system or technology, carefully investigate the opportunities raised by system or technology adoption, implications and impacts on its own business operation, do little pilot and tentative trial of the IS/IT, but closely monitor the trends of IS/IT change and technology champion among SC partners or in industries, and control the timing of IS/IT adoption process.

The vertical dimension – Supply Chain Interdependence refers to the IOR in SC context, and it reflects the relational view of mutual influence, exchange, interactions, knowledge and information sharing, coordination, cooperation, and integration (Dyer & Singh, 1998; Hart & Estrin, 1991; Oliver, 1990). The interdependence has two continuums: One is independent, it refers to the extent to which an organization has relatively powerful position in a SC network, has higher degree of decision making discretion and strong influence on other SC partners, the firm’s resources, operations and core values (knowledge, intangible assets, innovative capability) are not much dependent upon its SC partners, instead, the SC partners are heavily dependent upon the organization to operations and prosperity. The other extreme is

dependent, it refers to the extent to which an organization in a SC network has limited resources, influences, and constrained capabilities of changing SC structure and process, making decisions, bargaining for privilege information and favourable treatment. In addition, there are potential substitute firms in marketplace, they are competing for join the SC network with the dominant firm and replace those dependent organizations.

The framework posits that there are four strategies for focal organizations to adopt IS/IT in SCM context:

(1) *First Move Strategy*. It is an aggressive and self-motivated strategy driven by organizational intrinsic demand for advancement, privilege and advantages over SC partners. The firm, when uses this strategy, are theoretical supported by resource-based view and dynamic capabilities. Their resources (e.g. logistics system, IT infrastructure) are valuable, rare, and imperfectly imitable which compare with their partner in the supply chain. The firm should clearly recognize and foresee the benefits of IS/IT, and initiate potential changes for the firm and SC as a whole. Through adopting IS/IT, the firm can further consolidate its SC positioning among SC partners, and enhance its influence (legitimacy, imagine, technological capabilities, and strategic resources) and SC competitiveness. However, deployment of this strategy for IS/IT adoption is expensive, high demand organizational technology competence and resources; it also presents the firm with higher risk and lower measurable return of investment than other strategies in IS/IT adoption. Further, deployment of this strategy may require the firm to exercise its organizational power to “force” those unwilling SC partners to accept and use IS/IT accordingly. The another attractive feature of this strategy for the SC dominant firm is that the successful IS/IT adoption will build up competitive barriers against other SCs and competitors, and define the rules and norms of the game in its own SC context and in industries, such as technology standards, process and communication protocol, infrastructure. Those first move firms must have strong passion to be IS/IT champion, and take full spectrum of benefits and advantages, and achieve fully organizational commitment to devote resources into the adoption process.

(2) *Second Move Strategy*. It is a conservative IS/IT adoption strategy, and driven by the focal organization’s top management leadership style and organizational policies, stakeholders’ interests rather than brought opportunities and benefits from the IS/IT adoption. The firm, when deploying this strategy, has organizational resources, technology capability, SC position and influence, but it may regard IS/IT adoption an organizational and SC investment, therefore, analysis and evaluation of IS/IT adoption may focus on the return of investment and risk management, the firm may strive for a technology competent user, because the firm’s core values, relational-specific assets and sustainability may not be derived from technological innovation and advantages in SCM. Therefore, facing innovative or radical IS/IT change, the firm may have knowledge barriers to steer IS/IT adoption in SC context, the firm holds back, and take a “wait and see” attitude toward SCM system adoption.

The advantages of this strategy lie in its value orientation, and the rationale is in transaction cost theory. A firm does not invest resources in some unforeseeable projects with uncertainty in return and without obviously added values. Until the investment environment of IS/IT is favourable, the IS/IT is approaching mature, and the value-adding from investment of IS/IT adoption is achievable and accountable, the firm may take a positive view and active behaviour to approach IS/IT adoption. The disadvantage is obvious. Organizational adoption of the IS/IT cannot promote the technology leaderships among SC partners, it cannot establish competitiveness based on SCM system, but it can mainly use the IS/IT to enhance

operational efficiency and cost effectiveness, the strategic potential values of IS/IT in SC context cannot fully utilized.

(3) *Follow Up Strategy*. It is a passive strategy for articulating those SC partners who do not have an initiative for active IS/IT adoption. It is defined as those organizations are unable to deploy the IS/IT due to their limited organizational resources, small scale of business operations, and little SC influence on their partners. For those firms taking this strategy, the theoretical foundations are transaction cost theory and resource dependence theory, and their business transactions are largely dependent upon the dominant organization in SC network. Those firms generally adopt some nearly outdated IS/IT to support their business operations, to connect with the dominant firm and to process essential business information. From technology competency point view, these firms can hardly achieve a competent level, and the use of technology is simply to satisfy leading business partners' requirements and business procedure, and then reduce transaction loss and costs.

(4). *Technology Opportunism Strategy*. Technology opportunism is defined as a sense-and-respond capability of firms for proactive IS/IT adoption in responding to new opportunities in ways of not violating principle of fairness (Srinivasan, et al., 2002). The rationale lies on resource dependence theory which heavily relies on the external resources and collaboration with supply chain partners in their supply chains. There are two components of technology opportunism: technology sensing and technology response capabilities. Sensing capability is a firm's ability to scan internal and external innovative information, acquire knowledge about and understand new technology development, then to be able to provide innovative product and services derived from utilizing or deploying the technology; while the response capability is an organizational willingness and ability to respond to the new technologies, to reengineer its business strategy and explore the opportunities (Miles & Snow, 1978). A firm deploying technology opportunism strategy strongly believes that new IS/IT can create a great jump up opportunity, and thus, the firm proactively scans technological opportunities to capitalize them into its business process and operations. The firm is not stubbed to traditional principle and experience, but adherence to understand, analyze, and utilize new IS/IT technology for developing innovative products and services, and change its industrial and SC position. It is a strategy for ambitious and strongly self-motivated firm.

Table 2 summaries the four strategies in 12 strategy evaluation scales. The scales are developed to measure an organizational strategic readiness for IS/IT adoption. The scales, ranging from organizational, interorganizational and technological issues, imply the theory deployment in strategy selection for IS/IT adoption. The scales can be also used as a checklist to assist an organizational to make strategy choice, and evaluate whether the organization is ready enough to take a proactive strategy or not before embarking on the ways of IS/IT adoption.

#### **4. Summary**

Due to the significant contributions and IS/IT development, IS/IT adoption in a SCM context become a complicated theme, organization has to take many strategic factors and issues into decision making for IS/IT adoption. Facing such a tough task or challenge, we provide a literature review of IS/IT adoption, and reveal the theories underpinning the IS/IT adoption, and provide theoretical guidance – A strategic framework of strategies for the adoption, and identify the conditions and resources for organizations to initiate IS/IT adoption.

## References

- Agarwal, R., Tanniru, M. and Wilemon, D. "Assimilation information technology innovations: Strategies and moderating influences", *IEEE Transactions on Engineering Management*, (44:4), 1997, pp. 347 – 358.
- Barney, J. "Firm Resources and Sustained Competitive Advantage", *Journal of Management*, (17:1), 1991, pp. 99 – 120.
- Benson, J. K. "The Interorganizational Network as a Political Economy." *Administrative Science Quarterly*, (20:2), 1975, pp. 229 – 249.
- Blau, P. M. *Exchange and Power in Social Life*. Wiley, New York, 1964.
- Clemons, E., Row, M. "Sustainable IT advantage: The Role of Structural Differences." *MIS Quarterly*, (15:3), 1991, pp. 275 – 292.
- Dyer, J.H. "Effective Interfirm Collaboration: How Firms Minimize Transaction Costs and Maximize Transaction Value", *Strategic Management Journal*, (18:7), 1997, pp. 535 – 556.
- Dyer, J.H., Singh, H. "The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage", *Academy of Management Review*, (23:4), 1998, pp. 660 – 679.
- Emerson, R. M. "Power Dependence Relations", *American Sociological Review*, (27:1), 1962, pp. 31 – 41.
- Gaski, J. F., Nevin, J. R. "The Differential Effects of Exercised and Unexercised Power Source in a Marketing channel." *Journal of Marketing*, (22:2), 1985, pp. 130 – 142.
- Hart, P., Estrin, D. "Interorganizational Networks, Computer Integration, and Shifts in Interdependence: The Case of the Semiconductor Industry.", *ACM Transactions on Information Systems*, (9:4), 1991, pp. 370 – 417.
- Holland, C. P. "Cooperative Supply Chain Management: The Impact of Interorganizational Information Systems", *Journal of Strategic Information Systems*, (4:2), 1995, pp. 117 – 133.
- Johnston, R., Lawrence, P R. "Beyond Vertical integration – Rise of the Value-adding Partnership", *Harvard Business Review*, (66:4), 1988, July-August, pp.94 – 101.
- Mata, F. J., Fuerst, W.L., Barney, J. B. "Information Technology and Sustained Competitive Advantage: A Resource-Based Analysis." *MIS Quarterly*, (19:4), 1995, pp. 487 – 506.
- Miles, R. E., Snow, C. C. *Organizational Strategy, Structure and Process*. McGraw-Hill, New York, 1978.
- Oliver, C., "Determinants of Interorganizational Relationships: Integration and Future Directions.", *Academy of Management Review*, (15:2), 1990, pp. 241 – 265.
- Pfeffer, J. and Salancik, G. *External Control of Organizations: A Resource Dependence Perspective*. Harper and Row, New York, 1978.
- Provan, K. G. and Skinner, S. "Interorganizational Dependence and Control as Predictors of Opportunism in dealer – Supplier Relations.", *Academy of Management Journal*, (32:1), 1989, pp. 202 – 212.
- Premkumar, G. P., Ramamurthy, K. "The Role of Interorganizational and Organizational Factors on the Decision Mode for Adoption of Interorganizational Systems", *Decision Sciences*, (26:3), 1995, pp. 303 – 336.
- Rogers, E. M. *Diffusion of Innovations*. 3rd Edition, Free Press, New York, 1983.
- Rogers, E. M. *Diffusion of Innovations*. 5th Edition, Free Press, New York, 1995.
- Santhanam, R., Hartono, E. "Issues in Linking Information Technology Capability to Firm Performance", *MIS Quarterly*, (27:1), 2003, pp. 125 – 153.
- Srinivasan, R., Lilien, G. L., Rangaswamy, A. "Technological Opportunism and Radical Technology Adoption: An Application to e-business", *Journal of Marketing*, (66:3), 2002, pp. 47 – 60.



- Wernerfelt, B. "A Resource-based view of the Firm", *Strategic Management Journal*, (5:2), 1984, pp. 171 – 180
- Williamson, O. E. *Markets and Hierarchies: Analysis and Antitrust Implications: A Study in the Economics of Internal Organization*, New York: The Free Press, 1975.
- Williamson, O. E. "The Economics of Organization: The Transaction Cost Approach", *The American Journal of Sociology*, (87:2),1981, pp.233.
- Williamson, O. E. *The Economic Institutions of Capitalism*, Free Press, New York, 1985.
- Zhara, S. and George, G. "Absorptive Capability: A Review, Reconceptualization and Extension", *Academy of Management Review*, (27:2), 2002, pp. 185 – 203.