

Dimension Researches in Adoptions' Models of IOIS

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ABSTRACT

In this article we summarize researches on adoption' scenarios of Inter-Organizational Information Systems (IOIS), and comes up with suggestions from other views, and discusses influence of these elements.

INTRODUCTION

In recent years the share of inter-organizational business and transactions enabled by sophisticated inter-organizational information systems (IOIS) have steadily increased, and the trend is likely to continue. Although the development of internet technology in China is not long, internet technology has greatly changed the life of Chinese and operating models of enterprises. Which models of IOIS will Chinese enterprises adopt? Can Chinese enterprises span the general development process of information systems and directly enter the era of IOIS? These questions have inspired the experts all over the world with interest.

BACKGROUND OF IOIS

Johnston and Vitale's (1998) define IOIS as:

...an automated information system shared by two or more companies. An IOIS is built around information technology, that is, around computer and communication technology, that facilitates creation, storage, transformation and transmission of information. An IOIS differs from an internal distributed information system by allowing information to be sent across organizational boundaries. (p 154)

In our study, we also use this definition and stress that IOIS should be automated and across organizational boundaries.

The typical characteristic of IOIS is that it crosses organizational boundaries, which is very different from the information systems within the confines of an organization. The use of IOIS is tightly integrated with the form and nature of inter-organizational relationships.

Michael E. Porters have summarized such elements that have relationship with the focal enterprises as suppliers, consumers, competitors, administrations etc. Kai Reimers have defined an ISVS (Industry Segment Value System) as research unit (Reimers, Johnson & Klein, 2004). ISVS is an industry segment with three main parts and two kinds of relationships. Three main parts are focal industry segment and firms in their upstream and downstream stages. Focal industry segment may be producers or dealers of focal units and their rivals. Two kinds of relationships are horizontal and vertical relationships, which respectively correspond to the relationships between rivals and between their suppliers and buyers. Whatever by which research unit IOIS' users must solve the following problems, such as with which information formats to communicate with business partners, who maintenance IOIS and who pay for it. That is, they must solve IOIS' technical and economic problem.

CLASSIFICATION FROM THE POINT OF ECONOMIC NATURE OF IOIS

Chatterjee and Ravichandran have developed their studies from the economic nature of IOIS and put forth four dimensions to characterize an Inter-Organizational Information System (IOIS), namely, control, relational support, integration and technology dimensions (Chatterjee & Ravichandran, 2004). These four dimensions have covered

almost all the popular structures of existing IOIS. It is meaningful for us to study the possible matching relationship between structures of IOIS and industry structures

Table 1: Structure of Inter-organizational Systems.

Dimensions	Illustrative level of the dimensions Low -> high		
Control over IOIS financial	No user ownership	User as one of the many stakeholders	Full financial responsibility of user
Decision making	No user participation	Selective representation	User is the sole arbiter
Technology specificity	Broad based solution	Customized application of a mass technology	Dedicated organization specific proprietary solution
Integration with internal systems	No integration with internal systems	IOIS selectively integrated	Integrated with all relevant internal systems
Relational support	Arm's length relationships of buyers and suppliers	Preferred relationships either self selected or intermediary-mediated	Exclusive partner specific fixed relationship

[Chatterjee and Ravichandran, Error! Bookmark not defined., p.174]

CLASSIFICATION FROM THE POINT OF TECHNICAL NATURE OF IOIS

Joseph B.O'Donnell and Bonnie C. Glassberg have explored the technical nature of IOIS and given a structural comparison of systems types (O'Donnell & Glassberg, 2005).

Table 2: Structure of Inter-organizational Systems.

	Internet Web Site	Intranet (Internal)	IOIS		
			Extranet	B2B Virtual Market	EDI
Interacting parties	General public	Employees	Organization with business partner(s)	Organization with virtual market business partners(s)	Organization with specific business partner
System host	Organization	Organization	Organization	Network Market facilitator	Organization
Security	Data remains outside of outer firewall	Data stays inside inner firewall	Data stays between inner and outer firewalls	Inside inner firewall of network facilitator	Transactions allowed inside of inner firewall
Barrett and Konsynski IOIS level	Level 2- Application (Information) Processing Node	Not applicable	Level 4- Network Control Node	Level 5 - Integrated Network Node	Level 3 - Multiparticipant Exchange Node

[O'Donnell and Glassberg, Error! Bookmark not defined., p.35]

DISCUSSION ON TWO CLASSIFICATIONS

Driven by economic benefits the adoptions' models of IOIS in an industry are influenced by the characteristics of industrial structure, because economic benefit is strong related with characteristics of industry structure. So here we use an Industry Segment Value System (ISVS) as substitutes of an Industry structure to observe and analyze processes of adoptions of IOIS and predict its tendencies in the future. When we change different focal unit in an

ISVS, we get different windows of supply chain or value chain.

DIMENSIONS IN ADOPTIONS' MODELS

In standard industrial economics industry structure refers to the characteristics of the industry, such as the number and size distribution of firms in that industry and the barriers that impede other firms entering the industry, product differentiation, cost structures, price elasticity of demand (Douma & Schreuder, 1998). This concept can't cover all our assumptions. With an industry we discuss the adoptions' models of IOIS. Thus we plan to search for the factors from the two directions, industry structure characteristics and nation characteristics. From the aspect of industry structure we concentrate on the vertical and horizontal relationships around the focal industry segment. From the aspect of nation characteristics we pay attention to the formal and informal institutions.

INDUSTRY STRUCTURE CHARACTERISTICS

From Michael E. Porters' theory we discuss Industry structure with its five aspects, enterprise's vertical relationship, enterprise's horizontal relationship and influence of ownerships.

Vertical relationship

Vertical relationship means the relationships between the upstream and downstream firms, which are described with transaction cost economics theory. The product characteristics in a transaction reflect the vertical relationship along the supply chain. Besides them the asset specificity plays an important role in this study.

(1) Product Characteristics

Product Complexity/Uncertainty: From the transaction cost economics theory we can know that product complexity is an important dimension to describe a transaction. Product that are mature and fairly easily to describe within minimum specification requirements are considered to rate low in complexity. For example the prepaid telephone card or books. However an additional dimension related to product complexity is the complexity of the underlying technology, that is, uncertainty. Products can include some new technology or new innovations that man is not sure before the transactions. The transactions including uncertainty need more trust on both sides of the transaction. Related to IOIS they may have much closer relationships. On the other extreme, products can be complex to describe, require extensive specifications for relevant parameters, have high innovation content, and be based on an emergent and complex technology, such as new weapons business.

Frequency of transactions: In transaction cost economics theory the frequency of transactions is also an important dimension to scale a transaction. It also makes great sense to judge a transaction based on the IOIS. Seldom needed products will not attract more attentions of firms. They will have no interest to set up a fixed information system connect with such suppliers. But when for the regular needed products the situation is totally different. Firms expect to build a long term relationship and fixed connects. Besides frequency of transactions Chatterjee and Ravichandran have mentioned that quantity and pattern of consumption also play a role. Some products are seldom required, and do not form the regular bulk of an organization's input. Others might be consumed on a regular basis by an organization, but the consumption pattern fluctuated over time. Finally, organizations might need inputs that display a stable and predictable consumption pattern, and span a long time horizon. They have concluded all these characteristics as consumption characteristic.

Criticality of the resource: Chatterjee and Ravichandran mention the criticality of product as a third dimension. Independent of the complexity or consumption patterns, a product might be related to the core activities of an organization in varying degrees. Some products do not form the core consumption of an organization, and satisfy peripheral requirements. Others are critical to an organization's survival, and form the critical group of inputs required for an organization's core products and functions. Additionally, the criticality dimension depends on how widely a product is available. A product that forms the core procurement of the company might be less critical if it is more widely available than a product with limited source of supply.

Table 3: Product Characteristics.

Dimensions	Illustrative level of the dimensions Low --> High			
Product Complexity	Standard or mature products: based on mature and non specialized technology, easily specifiable	Standard products, based on sophisticated production systems. Detailed specification needs	Customized product, complexity of description, low innovation content	Highly customized product, high innovation component, new technology
Frequency of transactions	Infrequent consumption low value products	Sustained consumption, high fluctuation in consumption volume	Sustained consumption, moderate fluctuation, low predictability	Regular consumption, high predictability, long term consumption pattern exhibited
Criticality of the resource	Not related to the core business of the company. Widely available	Sustained requirement, but not related to the core competency of the company	Important input, large share of total sourcing expenditure, widely available	The most important input for the organization's sustenance. Limited sources of supply.

[Chatterjee and Ravichandran, **Error! Bookmark not defined.**, p.178]

(2) Resource characteristics

From the view of the asset specificity we can divide the relationships as three types: one-to-one, one-to-many, many-to-many.

The relationship one-to-one means the both sides of the transaction have asset specificity for each other. This is the closest relationship. According the transaction cost theory it is usually suggested that vertical integration or long-term contact will be a good way for both. When IOIS are adopted in this industry segment, the firms in two sides will hope to make full information integration as well as joint decision. If asymmetry exists between two sides, the stronger side will affect on the other side to adopt their favorable IOIS. For example, the relationship between motor-firms and auto-firms is in this case.

The relationship one-to-many means that one-side of the transaction has asset specificity and its products can only be sold to many buyers and these buyers can not buy the products from a second firm. Or the firms in one-side buy certain kind of products from many sellers, but these buyers can not find a second seller of these products. The firms in both sides have also incentives to bind with each other. In this case the two sides might make some level integration, such as partial access to operational information, and maintain collaboration at functional levels.

The relationship many-to-many means that two sides of transactions have no asset specificity. These products can be demanded or supplied by many firms. The collaboration between them seems temporary and changeful. In this case the adopted structure of IOIS will in great part depend on the product characteristics.

Table 4: Asset Specificity and Type of IOIS.

Asset Specificity	Low	Middle	High
Coordination approaches	Spot contract	Long-term contract	Vertical integration
E-commerce approaches	IOIS	IOIS , Bilateral EDI, Multilateral EDI	IOIS, Bilateral EDI, External system

[Chatterjee and Ravichandran, **Error! Bookmark not defined.**, p.178]

Horizontal relationship

The horizontal relationships are between the firms, which produce or deal in focal units. They are rivals and intensive rivalry exists among them. Intensity of rivalry depends on number and size of distribution of firms, level of product differentiation, and cost structures. In these dimensions the number and size of distribution of firms might influence the structure of IOIS in this industry. We can classify this distribution as monopoly, oligopoly and perfect competition.

In monopoly case there don't exist horizontal relationships. In the oligopoly case there exist only several large firms in this field, namely, oligopolist. It is not easy for them to drive their competitors out the industry, thus they select in certain extent to collaborate to keep higher profitability.

In perfect competition case there exist many small firms and one firm can not influence the market. They can get the information only from the rivals' action in markets. However they might have incentives to collaborate. Based on Prof. Reimer et al's conclusion the existing firms in the growth stage of an industry life cycle might cooperate on certain industrial standards or set up possible barriers to new entrants. They might together look for their new products' social acceptance. It is so called legitimation from the view of evolutionary approaches to organizations. In Shake-out stage the existing firms are hostile and desperate and struggle for survival. They carry out necessary cooperation in order to frustrate other rivals and keep themselves not being defeated.

In both oligopoly and perfect competitions cases industry institutions may play roles.

Ownership dimension

The agency theory stresses that the separation of ownership and control can bring different efficiency.

General speaking, the owner-controlled companies would be more profitable than manager-controlled companies. These firms are usually not large-scale and quickly responsive to the market or to the new technology. Manager-controlled companies have multi-aims and they can be seen as a nexus of contracts. Two kinds of manager-controlled companies draw our attentions, public corporations and private corporations. A large public corporation may be owned by many shareholders that no single shareholder owns a significant fraction of the outstanding stock. Therefore no single shareholder has the power really to control the actions of the officers of the corporation. Their decisions must embody the interest of most aspects in the corporation. A private corporation may also be owned by many shareholders, but there is a shareholder who owns a significant fraction and has the power really to control the corporation. Then the decisions of the corporation embody the willing of the big-stockholder. Especially corporations that the big-stockholder is one state, state-controlled corporation, usually embody national benefits and social needs. The maximization of profits takes a second place.

NATION CHARACTERISTICS

Institutions form the incentive structure of a society and the political and economic institutions, in consequence, are the underlying determinant of economic performance (North, 1993). Institutions are the humanly devised constraints that structure human interaction. They are made up of formal constraints (rules, laws, constitutions), informal constraints (norms of behavior, conventions, and self imposed codes of conduct), and their enforcement characteristics. Institutions and the technology employed determine the transaction and transformation costs that add up to the costs of production. The emergency of IOIS offers a possibility to reduce the transaction costs through employing new technology. But different institutions can bring different efficiency even under the same technology. Thus it is necessary to take institution as a dimension to explore the applying schema of IOIS.

The economic formal institutions aim at reducing transaction costs and they are transferable. Because of the comparability of social development formal institutions in a nation can be applied in the other nations. But unchangeable copied formal institutions don't work properly in other nations. Because formal institutions should come from the existing transaction needs, which base on many informal constraints, such as norms of behavior,

conventions, etc. People in different county have different norms of behavior and conventions. Thus the informal constraints are also the key variables to decide the method of applying a new technology, for example, applying IOIS. These informal constraints can include many aspects, such as ways to conduct a business, etc.

CONCLUSION

From above we can see that IOIS can be adopted among different relationships of firms, such as horizontal relationships, vertical relationships, even relationships between firms and their administrators, institutions, etc.. As for which model is adopted, that will depend on their various elements, such as product characteristics, resource characteristics, number and size of firms, ownerships, even nation characteristics, etc.

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