

Interorganizational Systems From Different Perspectives

M.K.M. Ibrahim

Department of Information Systems and Management
Tilburg University, Postbox 90153, 5000 LE Tilburg, The Netherlands

Tel. +31 13 466 8080

m.k.m.Ibrahim@uvt.nl

Abstract

The adoption and use of IOS's by organizations has proved to be difficult and complicated due to a number of reasons. Accordingly, IOS research has been distributed into multiple streams. This paper discusses four widely used theoretical perspectives and the IOS literature related to each perspective. The perspectives are transaction cost economics, incomplete contracts theory, adoption theory and resource dependence theory.

1. Introduction

Organizations are compelled to develop interorganizational relationships (IORs) to enable a range of activities such as supplying goods, research and development (R&D), and outsourcing. The use of information technology can facilitate a smooth flow of information from one organization to another using interorganizational systems (IOSs) - automated information systems shared by more than one organization and allowing information flow across organizational boundaries. IOSs can reduce the costs of communications and at the same time extend the possibilities of coordination. The academic literature that discusses IOSs is massive and applies many theoretical perspectives to view and analyze issues regarding the use of IOSs within interorganizational relationships. The objective of this paper is to provide a brief review of four widely used theoretical perspectives and the main IOS literature related to each perspective. The four perspectives are transaction cost economics, incomplete contracts theory, adoption theory and resource dependence theory.

The organization of the paper is as follows. Each of the sections two till five will discuss a theoretical perspective by first providing a concise review of the theory and consequently the IOS literature that uses that particular theory. Finally section six will provide a brief conclusion of the paper.

2. Transaction Cost Economics

The Theory

Transaction cost economics (TCE) concentrates on the make or buy decision. The theory argues that it is more efficient for an organization to buy a standard product externally from a special supplier who is an expert in producing that product than to produce the product internally. Nonetheless, buying products on the market can be less attractive when certain conditions apply such as for example when the organization needs a specific customized product. The organization is forced to internalize production under these conditions. TCE justifies why and predicts when an organization chooses to internalize the production process or conduct market exchange to acquire the product.

TCE identifies two types of costs that have to be considered to determine whether a transaction should take place externally on the market or internally within the firm: production costs and transaction costs. On the one hand, acquiring a product on the market is argued to lower production costs and to raise transaction costs. The production costs decline due to the economies of scale and specialization advantages the supplier benefit from. The transaction costs raises due the required negotiations and monitoring within the market. On the other hand, producing a product internally increases the production costs and lowers transaction costs. Hence, the organization will choose the most attractive alternative that minimizes the total costs.

The amount of transaction costs depends primarily on three factors [36]. First, the frequency of contracting; active first within a specific market usually have more knowledge regarding market conditions, traded

products and active suppliers within the market than markets that do not use the market as often. Second, the degree of uncertainty; uncertainty can arise from technological changes, unpredictable changes in consumer preferences or strategic behavior regarding nondisclosure and distortion of information. Third, the degree of asset specificity, which is the degree to which assets are specifically designed for a particular objective. TCE contends that transactions that are characterized by higher levels of asset specificity should be produced by organizations internally because such assets only can be redeployed at a great loss in values resulting in considerable quasi-rents.

IOS Literature Using The TCE Theory

IOS Research applying the TCE has tried to investigate the impact of IOS on the transaction structure. Malone [24] proposed the 'electronic markets hypothesis, which argues that information technology will reduce the information coordination costs and this will encourage the use of electronic markets. He contends that eventually electronic markets will obtain the preference above electronic hierarchies for coordinating economic activities. Clemons et al [7] disagreed and proposed the 'move to the middle hypothesis, where they argue that information technology in the form of IOS will reduce coordination costs, operation risks and opportunism risks. Because of these reductions, it will be more efficient to create long-term relationships with a smaller number of suppliers. Gurbaxani and Whang [14] focused on three types of costs: external and internal coordination costs and operating costs. They argue that information technology has shrunk external and internal coordination costs and improve the operational efficiency. Consequently, the use of both electronic markets and electronic hierarchies will be increased. Moreover, they content that the general impact of information technology will largely depend on the factors specific to the organization and the industry.

TCE has enabled scholars to justify the formation of many IORs and the use of IOSs within these relationships. The limited focus of TCE on short term cost minimization results in the ignorance to consider other important criteria such as social issues and learning within the relationship. These criteria can have a significant impact on the relationship.

3. Incomplete Contracts

The Theory

A complete contract is a contractual agreement between economic agents that specifies the responsibilities of each party in every possible situation or contingency. Williamson [36,37] and Maskin and Tirole [25] reason that contracts are almost never complete. As discussed earlier, Williamson [37] argues that the cost of contracting and subsequently enforcing these contracts depends on the chosen governance structure, i.e. market or hierarchical. Grossman and Hart [13] contend that each governance structure involve a different type of contractual rights: specific and residual rights. If it is too costly to stipulate all the specific rights in the contract, then all the rights will be transferred excluding few rights that are mentioned in the contracts. Therefore, ownership is important in the incomplete contract theory. Ownership dictates the destiny of an asset in contingencies not described in the contract, that is to say ownership is the purchase of the residual rights of control [3, 13]. Because contracts are almost never complete, owners have a relatively stronger position compared with non-owners because they mostly acquire the residual income streams due to their strong negotiating position.

There are several reasons that compel contracts to be incomplete. Hart and Moore [16] argue that some contractual terms are unverifiable because they are not commonly observable by all parties or more specifically the party that is responsible for enforcing the contract (e.g. the court). Second, Grossman and Hart [13] contend that is impossible to incorporate every potential contingency in the contract. Because the parties cannot identify ex ante all possible ex post contingencies, they are constrain to an incomplete contract they does not enclose all contingencies. Third, even though some contingencies can be predicted, discussing and writing them into a contract may not take place. Maskin and Tirole [25] point out that this can be due to the high transaction costs of describing the possible states of nature. As a result of these three reasons, there will be some possible contingency not included in the contract making the contract incomplete.

IOS Literature Using The Incomplete Contracts Theory

Incomplete contracts theory has considerable relevance to IOS theories. IOS contracts are inherently incomplete as all three earlier discussed reasons that cause contracts to be incomplete are present [15]. First, the use of an IOS necessitates asset-specific investments in IT assets such as hardware, software and also complementary investments in assets such as expertise and training. These investments can be hard to

observe by the other participants involved and perhaps impossible to verify by a third party. Second, the various applications of IOS for different activities make it difficult to foresee all the contingencies. Due to the high speed of environmental change, organizations need to react frequently and change their strategies to adapt to the environmental change. This can be even exacerbated when the value of the IOS increases with the number of organizations employing the IOS. This is the case for electronic market places. Finally, some future contingencies can be foreseen and nevertheless, organizations may choose not to put them in the contract. This is observed when organizations create partnerships. Organizations choose to enter long-term relationships without specifying all contingencies and instead relying on the interorganizational trust present within the relationship.

The failure to attain complete contracts underlines the importance of IOS ownership as portrayed by the case of the Airline Computer Reservation Systems (CRS's). The CRS's were traditionally owned by the individual airlines and American Airways and United Airlines were leading and affecting the market. Smaller airlines contended that American and United should divest their CRS's to create independent intermediaries. This ownership structure would serve competition better and encourage higher levels of investment, and eventually higher economic surplus.

The incomplete contract theory was used by Bakos and Brynjolfsson [2] to determine the optimal strategy for buying organizations that use IOS. They argue that buying organization can maximize their profits by reducing their bargaining power through limiting commitments to a small number of suppliers. Even though this is apparently inconsistent, the reduction in the number of suppliers is required to persuade suppliers to conduct noncontractible investments. This is explained by the rationale that when a suppliers perceive a particular buyer to be dependent and willing to enter a long term relationship, then the supplier will be more willing to conduct asset specific investments. Another IOS related application of incomplete contracts theory is regarding the ownership structures in electronic networks. Bakos and Nault [3] argue that if there are one or more essential assets for the functioning of the IOS, then all the assets of the IOS should be owned together. Hence, common ownership by all participants is optimal when an IOS requires essential assets, such as a common IT infrastructure. Furthermore, they argue that when essential assets and indispensable participants are absent, sole ownership will not be the optimal ownership structure. Therefore, if IOS partners want to prevent any single party from controlling the IOS, then they should make certain that the IOS doesn't need any essential assets and if there are such assets, then they should be owned by everyone.

Banker, Kalvenes and Patterson [4] argue, contrary to the mainstream, that IT increases contract completeness. They contend that the progress in communication technologies will reduce monitoring costs. It will be possible to increase monitoring and some parts of the contract will be converted from non-contractible to contractible. The buyer may then choose to enter more terms in the contract to decrease his risk and make the contract more complete. Due to these additional contractual terms, the cost of monitoring for that particular supplier will increase. Banker, Kalvenes and Patterson [4] contend that the decrease of transaction costs generated by IT will be cancelled and surpassed by the increase in contractual terms and monitoring costs per supplier, leading to a reduction in the optimal number of suppliers. This shows that the claims of Bakos and Brynjolfsson [2] and Clemons et al [7] hold under the more general conditions of Banker, Kalvenes and Patterson [4].

4. Adoption Theory

The Theory

Adoption generally refers to the decision of any individual or organization to make use of an innovation [12]. IOS adoption research has been influenced by the broad organizational adoption approach [32] significantly [6, 27]. This approach emphasizes that adoption can be based on the perceived characteristics of the innovation. Rogers [32] identified five characteristics that can either facilitate or impede the adoption of an innovation. First, relative advantage is the extent to which the innovation is perceived better than that it is replacing. Second, compatibility is the perceived consistency of the values, needs, and experiences of potential adopters with the innovation. Third, complexity is the extent to which an innovation is difficult to understand. Fourth, triability refers to the extent to which an innovation can be experimented on before a full commitment must be made. Finally, observability is the degree to which the benefits of the proposed innovation are visible. These characteristics are primarily based on individual-level adoption decisions.

Framback and Schillewaert [12] argued that features of the adopting organization can affect the adoption process and they pointed out to three main organizational features. First, the size of the organization is argued

to be positively or negatively related to innovation adoption. On the one hand, larger organizations are under higher pressure to adopt innovations to support and improve their performance [32]. On the other hand, smaller organizations are more flexible and have enhanced receptiveness towards new innovations. This apparent inconsistency can be accredited to the relationship of organization size with other organizational features, such as structure, strategy and culture. Organizational structure is the second feature argued to influence organizational adoption. Organizational structure is shaped by multiple attributes, which can have diverse impacts on adoption. High levels of centralization and formalization have a tendency to encourage the implementation of adoption decision, while low interconnectedness have a tendency to inhibit the information flow and consequently the implementation of the adoption. Finally, the degree of organizational innovativeness influences the adoption propensity. For example, Hurley and Hult [20] point out that organizational cultures that call attention to learning, development and participative decision-making produce higher levels of innovation.

IOS Literature Using The Adoption Theory

The IOS literature has identified three main groups of factors that influence the adoption of IOS: nature of the technology adopted, the adopting organization, and the interorganizational relationships or more generally the external environment [23].

The nature of the adopted technology may create difficulties for the adopting organizations. Important factors regarding the technology that effect IOS adoption comprise network security, system integration, data conversion and the compatibility of software and hardware [22]. The security is a key issue as IT do not always fulfill the transaction safety requirements of organizations [31]. Moreover, the adoption of an IOS may generate complex and expensive integration issues. The integration of the IOS with the internal IS can involve rigorous technical efforts involving activities such as the conversion of program codes, databases and the validation of data formats [35].

The second group of factors that influence IOS adoption consists of organizational factors. Organizations participate in IOSs or adopt new innovations in general only when they offer better benefits compared with the previous situation [32]. IOS benefits can range from modest gains such as reduced communication costs and improved customer service [14, 30] to transformative advantages that enhance competitive advantage [26], enable business process reengineering and support industry value chain integration [6]. Besides the benefits, the compatibility of the IOS with existing organizational policies, procedures, values, and systems and top management support are mostly perceived as relevant aspects of IOS innovation and adoption [6, 21, 27].

The third group of factors consists of the stimulators and barriers that other organizations set on the focal organization to enhance or inhibit the adoption of IOS. Competitive pressure and exercised power have been found to influence EDI adoption [30]. Hart and Saunders found both power and trust are important issue for adoption and use. Powerful organizations can manipulate their partners in two ways. The powerful organization can induce its partners to adopt the new technology by providing rewards and benefits or it can force them to adopt it with the threat of abandoning the partner if it rejects. Trust is also identified as an important factor as its presence can provide monitoring and transaction cost reductions and its abuse will initiate a vicious cycle and impede constructive cooperations [18].

5. Resource Dependence Theory

The Theory

The roots of resource dependence theory (RDT) can be found in an article by Emerson in 1962 where he illustrated the analogy between power and dependence across all forms of social relationships [11]. Emerson argued that the dependence of a party B on party A is a function of availability and motivational investment and is directly comparative to the power of A over B. In economic expressions, this is known as supply and demand. The theory of Emerson was later applied by Pfeffer and Salancik [28] to analyze the relationship between the organization and its external environment. They distinguished between general structural characteristics that describe the entire environment and particular relationships among identifiable social actors. The three most elemental structural characteristics of the environment are concentration, munificence, and interconnectedness. Concentration is the level of diffusion of power and authority within the environment, munificence is the level of availability or shortage of critical resources, and interconnectedness is the number and configuration of connections between organizations. These three structural characteristics shape the general relationships between social actors. On an individual level, the degree of dependence that

an individual organization faces is determined by the importance of the externally controlled resources to the success of the focal organization, the degree of discretion that the external environment has over the resource allocation of that resource and finally the number of alternatives to that particular resource.

The RDT acknowledges that a single organization can not produce or own all the required resources for its operations. The organization is forced to acquire these resources from several other actors and organizations in its environment. Therefore, a successful organization is an organization that is able to satisfy the demands of the various stakeholders such as employees, customers and shareholders. To realize this, the organization can choose between three alternative types of action to deal with the demands of the external environment: it can avoid them, comply with them or try to modify them to acquire a better set of demands, which can be fulfilled easier. The third alternative is the main focus of RDT. The theory contends that organizations conduct actions to reduce their dependence on other organizations and the risk that is emanating from these dependencies. The dependencies can be modified using two strategies. The first strategy is the ownership-alteration strategy, which implies that the needed external resource should be purchased. This can result in vertical integration, horizontal integration and diversification. The second strategy entails creating a quasi-hierarchical relationship to govern the uncertainty within the relationship. Examples of quasi-hierarchical relations are joint ventures, interlocking boards of directors, associations and cartels. The purpose of both strategies is to create stability by achieving better planning and more accurate forecasting. Basically, the organization will try to reduce its dependence on the environment by constantly balancing two contradictory forces: certainty and autonomy [9].

IOS Literature Using The Resource Dependence Theory

The interdependence between organizations is the focus of IOS literature that uses the resource dependence theory. Various authors found that more effective use of IOS can be related to the level of integration between the interorganizational IT infrastructure and the internal IT infrastructure of each organization [5, 8, 17]. This high integration results in higher interdependence between the organizations [10, 17]. Therefore, intensive use of interorganizational systems results in a shift in the relationship between organizations to a reciprocal interdependence, that is the outputs of each organization become inputs for one or more of the other organizations. Thompson argued that reciprocal interdependence has to be kept low in the organization structure [33]. Consequently a potential disadvantage of interorganizational systems is that they can make entire organizations reciprocally interdependent on each other. The impact of this interdependence under future unexpected results is unknown; this can decrease the flexibility of organizations and produce new uncertainties. Furthermore, it illustrates the argument of Pfeffer and Salancik [28] that organizations react to the uncertainty problems by intensifying their interconnectedness by coordinating their behaviors in ways predictable to each other. This will produce higher interorganizational interdependence and new uncertainties that were not present in the initial situation.

Furthermore, the use of IOS is argued to influence the power and control structures within interorganizational relationships [1, 17]. The propositions on how IOSs influence the power and control are divided along two directions. Some literature, mostly earlier published, argued that the use of IOS's is exclusive to selected organizations that fulfilled the demands and rigorous criteria to join. They mostly referred to EDI systems that needed high set up costs. The technology restricted the IOS to organizations that possessed the required resources. Recent literature contends that the use of modern IOS leads to more just relationships between organizations [1, 34]. Angeles [1] argued that I-EDI modifies the power structure by transfer the power from large hub organizations to smaller and mid-sized organizations. The large organizations used previously their central position to dictate the terms of relationships and they exploited this by utilizing power to their favor. The progress of IT has and the emergence of standards, such as XML and ebXML, has enabled small and mid-sized organizations to have a broader choice of trading partners.

6. Conclusion

IOSs are used in various ways to facilitate interorganizational relationships. This paper has provided a concise review of four theoretical perspectives that are used within the IOS literature. TCE has received significant attention within IOS literature as it focuses on how organizations should organize their boundary-spanning activities so as to minimize the sum of its production and transaction costs. Information technology has major affects on interorganizational communications and coordination and consequently TCE has been used to study the impact of IOS on production and transaction costs. The second perspective discussed was incomplete contracts theory. This perspective is relevant to the study of IOSs as IOS contracts are inherently incomplete in the three perspectives; the IOS requires asset specific investments that are hard

to observe by other parties involved, it is difficult to foresee all contingencies related to IOSs as they can be involved in many complex activities and even some contingencies that are foreseen are not included in the contract. The third perspective discussed is adoption theory. Theories using this perspective have illustrated that the adoption and use of an IOS is dependent on three main groups of factors; the nature of IOS technology being adopted as some technologies can create difficulties that inhibit successful adoption, the adopting organization as it is mainly the organization that need to initiate and execute the adoption and the relationship with other organizations as the use of the IOS's can have a major impact on the IORs. Finally, the resource dependence theory was discussed and how it is used to analyze the impact of IOSs on the interdependence within IORs. IORs are found to influence the power structure within IORs as they can eliminate the power of big organizations that operated as hubs and forced small organizations to follow their regulations.

References

1. Angeles, R. (2000), "Revisiting the role of Internet-EDI in the current electronic scene," *Logistics Information Management*, 13 (1), 45-57.
2. Bakos, J.Y. and Erik Brynjolfsson (1993), "Infoamtion Technology, Incentives and the Optimal Number of Suppliers," *Journal of Management Information Systems*, 10 (2), 37.
3. Bakos, Y. and B. Nault (1997), "Ownership and Investment in Electronic Networks," *Information Systems Research*, 8 (4), 321-41.
4. Banker, R., J. Kalvenes, and R. Patterson (2000), "Information Technology, Contract Completeness and Buyer-Supplier Relationships," in *The 21st Annual International Conference on Information Systems*. Brisbane, Australia.
5. Chandrashekar, A. and P. Schary (1999), "Toward the Virtual Supply Chain: The Convergence of IT and Organization," *The International Journal of Logistics Management*, 10 (2), 27-39.
6. Chwelos, P., I. Benbasat, and A.S. Dexter (2001), "Research Report: Empirical Test of an EDI Adoption Model," *Information Systems Research*, 12, 304-21.
7. Clemons, Erik K., Sashidhar P. Reddi, and Micheal C. Row (1993), "The Impact of Information Technology on the Organization of Economic Activity: The "Move to the Middle" Hypothesis," *Journal of Management Information Systems*, 10 (2), 9-35.
8. D'Amours, S., B. Montreuil, P. Lefrancois, and F. Soumis (1999), "Networked manufacturing: The impact of information sharing," *international journal of production economics*, 58 (1), 63-79.
9. Davis, Gerald and Walter Powell (1992), "Organization-environment relations," in *Handbook of Industrial and Organizational Psychology*, M. Dunnette and L. Hough, Eds. Vol. 3. Palo Alto CA: Consulting Psychologists Press.
10. Ekering, Chad F. (2000), *De Specificiteit van EDI*: Dutch University Press.
11. Emerson, R.M. (1962), "Power-dependence relations," *American Sociological Review*, 27, 31-41.
12. Frambach, R.T. and N. Schillewaert (2002), "Organizational innovation adoption: a multi-level framework of determinants and opportunities for future research," *Journal of Business Research*, 55 (2), 163-76.
13. Grossman, S.J. and O.D. Hart (1986), "The costs and benefits of ownership: A theory of vertical and lateral integration," *Journal of Political Economy*, 94 (4), 691-719.
14. Gurbaxani, V. and S. Whang (1991), "The Impact Of Information Systems On Organizations and Markets," *Communications of the ACM*, 34 (1), 59-73.
15. Han, K., R.J. Kauffman, and B.R. Nault (2003), "Who Should Own IT? Ownership and Incomplete Contracts in Interorganizational Systems," Working Paper.
16. Hart, O. and J. Moore (1988), "Incomplete Contracts and Renegotiation," *Econometrica*, 56, 755-85.
17. Hart, P. and D. Estrin (1991), "Inter-Organization Networks, Computer Integration, and Shifts in Interdependence: The Case of the Semiconductor Industry," *ACM Transaction on Information Systems*, 9 (4), 370-98.
18. Hart, P. and C. Saunders (1997), "Power and Trust: Critical Factors in the Adoption and Use of Electronic Data Interchange," *Organization Science*, 8 (1), 23-42.
19. Holland, C.P. and A.G. Lockett (1997), "Mixed Mode Network Structures: The Strategic Use of Electronic Communication by Organizations," *Organization Science*, 8 (5), 475-88.
20. Hurley, R.F. and G.T.M. Hult (1998), "Innovation, Market Orientation and Organizational Learning: An Integration and Empirical Examination," *Journal of Marketing*, 62 (3), 42-54.
21. Iacovou, C.L., I. Benbasat, and A.S. Dexter (1995), "Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology," *MIS Quarterly*, 19 (4), 465-85.

22. Jones, M.C. and R.C. Beatty (1998), "Towards the development of measures of perceived benefits and compatibility of EDI: a comparative assessment of competing first order factor models," *European Journal of information systems*, 7 (3), 210-20.
23. Kurnia, S. and R.B. Johnston (2000), "The need for a processual view of inter-organizational systems adoption," *The Journal of strategic information systems*, 9 (4), 295-319.
24. Malone, T.W., J. Yates, and R.I. Benjamin (1987), "Electronic Markets and Electronic Hierarchies: Effects of Information Technologies on Market Structure and Corporate Strategies," *Communications of the ACM*, 30 (6), 484-97.
25. Maskin, Eric and Jean Tirole (1999), "Unforeseen Contingencies and Incomplete Contracts," *Review of Economic Studies*, 66 (1), 83-114.
26. Mukhopadhyay, T., S. Kekre, and S. Kalathur (1995), "Business Value of Information Technology: A Study of Electronic Data Interchange," *MIS Quarterly*, 19 (2), 137-56.
27. O'Callaghan, R., P.J. Kauffman, and B. Konsynski (1992), "Adoption Correlates and Share Effects of Electronic Data Enterchange Systems in Marketing Channels," *Journal of Marketing*, 56 (2), 45-56.
28. Pfeffer, Jeffrey and Gerald R. Salancik (1978), *The External Control of organizations: A resource dependence perspective*. New York: Harper & Row.
29. Premkumar, G. and K. Ramamurthy (1995), "The Role of Interorganizational and Organizational Factors on the Decision Mode for Adoption of Interorganizational Systems," *Decision Sciences*, 26 (3), 303-36.
30. Premkumar, G., K. Ramamurthy, and S. Nilakanta (1994), "Implementation of electronic data interchange: an innovation diffusion perspective," *Journal of Management Information Systems*, 11 (2), 157-86.
31. Ratnasingam, Pauline Puvanasvari (2001), *Interorganizational Trust in Business to Business E-Commerce*. Rotterdam: Erasmus Research Institute of Management (ERIM).
32. Rogers, Everett M. (1995), *Diffusion of Innovations* (Fourth ed.). New York: The Free Press.
33. Thompson, James D. (1967), *Organizations in action*. New York: McGraw-Hill.
34. Threlkel, M.S. and B. Kavan (1999), "From traditional EDI to Internet-based EDI: managerial considerations," *Journal of Information Management*, 14, 347-60.
35. Truman, G.E. (2000), "Integration in Electronic Exchange Environments," *Journal of Management Information Systems*, 17 (1), 209-45.
36. Williamson, O.E. (1985), *The Economic Institutions of Capitalism*. New York: Free Press.
37. --- (1975), *Markets and Hierarchies*. New York: Free Press.