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USING ORGANIZATION THEORY FOR INTER-ORGANIZATIONAL SYSTEMS RESEARCH

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Abstract

This paper considers inter-organizational systems (IOSs) as links between organizations and their environment. The organization theory literature is reviewed to address the organization-environment interaction, and the three views of IOS environments are put forward: the deterministic model; the proactive model; and the information model. Each model is based on different assumptions about the role that an IOS can play in dealing with the environment. These three models are used to develop different propositions about the characteristics of environments suitable for IOSs. In addition, research propositions are developed along two other broad research questions: the organizational impact of IOSs, and the success factors for establishing IOSs. Although the resulting propositions are not intended to be an exhaustive test, they reflect how the findings in the literature can contribute to IOS thinking.

This paper attempts to fill a theoretical void in the inter-organizational systems (IOS) literature by using organizational theory as a reference discipline. Since its main contribution is in the area of hypothesis generation, it should be viewed as a first step in IOS theory development.

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Caveat: This paper is based on research that I did in 1986 when I was in the doctoral program at the Harvard Business School. Therefore, the review of the organization theory literature does not account for work that has been carried out in recent years.

USING ORGANIZATION THEORY FOR INTER-ORGANIZATIONAL SYSTEMS RESEARCH

Inter-organizational systems (IOSs) are defined as automated information systems shared by two or more separate companies [5]. An IOS consists of computer and communications infrastructure that allows the participating organizations to share in the execution of an application [8].

Although similar to distributed systems in technological infrastructure, IOSs are different in other aspects. Cash and Konsynski [9] provide four characteristics that differentiate IOSs:

External focus: whereas a distributed system is under the control of a single company, an IOS crosses company boundaries and involves trans-company data flows. These flows allow an employee in one company to allocate resources and initiate business processes in another company.

Existence of facilitators: the figure of the IOS facilitator doesn't exist in distributed systems. An IOS facilitator is an organization whose primary business is to help in the development, operation, or utilization of an IOS (e.g. the use of third party value added networks (VANs) can ease the problems of incompatibility in computer-to-computer linkages).

Regulation: the question of government regulation arises as a result of the information exchange across the boundaries of separate organizations and hence across separate legal entities. A potential issue may be legal liability. E.g. when does the electronic message passing over the communication line actually become an order?

Competitive implications: an IOS frequently has a broader and more significant potential competitive impact than the traditional internal IS applications. Whereas many internal applications are intended for cost reduction and greater operating efficiency, external applications (i.e. IOSs) can be used to control market access, differentiate product offerings, build in switching costs, and shift bargaining power in buyer-supplier relationships.

This paper concentrates on the first of these characteristics. Due to their external focus, IOSs can be viewed as linkages between organizations and their environments. Such an approach brings up questions about the type of environment appropriate for IOSs. For example: in what environments are IOSs more likely to emerge?

The development of IOSs often requires massive investments in computers and data communications facilities. Are organizations willing to make such commitments only in stable environments? What are the opportunities in other kinds of environment (e.g. more dynamic, more complex)?

Dealing with the environment boils down to establishing linkages and interacting with other organizations. What inter-organizational relations lend themselves to IOSs? And also, can an organization use IOSs for managing the environment to its advantage?

Another set of questions refers to organizational impacts; i.e. how the use of IOSs is seen internally in the organization. What organizational changes (e.g. structure, processes, staff, technology, etc.) are needed to adopt an IOS? Are all organizations equally prepared to stand the IOS impact?

In addition, IOSs involve more than one organization. This characteristic makes IOSs a sort of joint venture. What are the incentives for potential participants to join in? Given that a joint effort is required, IOSs can be viewed as coalitions. In that case, what are the factors for the success of the IOS coalition?

To shed some light on these questions, this paper reviews the organization theory literature that refers to the organization-environment interaction; and, using the findings in the literature, develops models for assessing IOS environments and suggests propositions for IOS research.

Organizational Environments

Organizations can be viewed as open systems that import resources and information from the environment and transform them into outputs that are exported back to the environment. In terms of domains of influence, it is useful to think of the environment in two ways: 1) the general environment (societal) which affects all organizations in a given society, and 2) the specific (task) environment which affects the individual organization more directly [16].

While the general environment is similar for all organizations in a given society, the task environment is different for each organization. The task environment contains the components that are most relevant to an organization; i.e., customers, distributors, suppliers, competitors, government (regulations), public attitude, trade unions, technology, etc. [11, 12, 34].

The organization-environment interaction takes place through the linkages between an organization and the other organizations in the task environment. These linkages are usually referred to as “inter-organizational” relations. Marret [24] provides four dimensions that characterize inter-organizational relations [28]:

Formalization of Relationship

- Agreement formalization: Is there a legislation or a contract?
- Structure formalization: Is there a formal intermediary?

Intensity of Relationship

- Size of resource investment in the relationship: Are a large number of resources committed to the other organization?
- Frequency of interaction: How often do the organizations interact?

Reciprocity in the Relationship

- Resource reciprocity: Are resources flowing one way or both ways?
- Definitional reciprocity: Have the organizations had a chance to mutually agree on the terms of the interaction?

Standardization of Relationship

- Standardized units: Are the units being exchanged essentially standard, or quite different?
- Procedural standardization: Are the procedures of exchange fairly standard and agreed upon?

This typology can be used to characterize IOS environments, and the above dimensions can be seen as determinants of IOS emergence. Therefore, it can be hypothesized that the degree of formality, intensity, reciprocity, and standardization will determine which inter-organizational relations lend themselves to IOSs. This view assumes that an IOS is developed to support a given set of pre-existing inter-organizational relations. The characteristics of the inter-organizational relationships thus determine the use of the IOS. This approach will be referred to as the "*deterministic model*" of IOS environments.

The Deterministic Model

The deterministic view seeks to understand what environments are appropriate for IOSs by looking at the characteristics of existing inter-organizational relations. Aldrich suggests that a stable environment leads to the development of formalized relations with other organizations because it increases the opportunities for and the predictability of contacts between organizations [28]. The concentration of resources (intensity) attracts those organizations which seek to exploit those resources by entering into more frequent interaction with the organization holding the resources. A high frequency of interaction, in turn, leads to the development of more formalized relations as organizational learning takes place and each organization gives the transaction formal recognition. Reciprocity and standardization in the relationship make it easier to maintain for longer periods of time.

It can be hypothesized that the more formalized the inter-organizational relationship, the more likely it is to be supported by an IOS. The more formalized inter-organizational relations take place in more stable environments and also between firms with high intensity relations. In summary, the following propositions are suggested:

Proposition 1: IOSs will be developed between firms with a high-intensity relationship (large number of resources committed to the other organization and high frequency of interaction).

Proposition 2: IOSs will be developed in stable environments.

Proposition 3: IOSs will be developed between firms whose interaction involves a high degree of standardization (in procedures, and in units exchanged).

The preceding view is "deterministic" because it assumes that IOS use is determined by the characteristics of the environment and the existing inter-organizational relations. Furthermore, the "deterministic model" presents a reactive view of IOSs because it assumes that IOSs do not change the environment.

The Proactive Model

The preceding "deterministic model" provides a limited view of IOS environments. In particular, it cannot account for one of the characteristics that differentiate IOSs from other systems: their potential competitive impact [9] and, thus, their ability to affect the environment.

The view that IOSs present opportunities to influence the environment to the organization's advantage is core to the "*proactive model*." Strategic uses of IOSs, especially those inducing switching costs, can be included in this category.

Whereas the "deterministic model" considers environmental stability as being causal for IOS use, the "proactive" model reverses this logic. Under the proactive model, the use of IOSs is supposed to lead towards more stable inter-organizational relations. Pfeffer and Leblebici [31] suggest an analogy between the behavior among groups of individuals and the behavior that occurs among groups of organizations. Over time, the authors say, individual social units find it mutually advantageous to interlock their behaviors to stabilize patterns of action and interaction. Once these patterns are stabilized, uncertainty is reduced. Pfeffer and Leblebici suggest that organizations follow a similar pattern.

IOSs can thus be seen as a means of achieving interlocking behavior among organizations. IOSs would contribute to stabilizing interactions and thus reducing uncertainty.

Proposition 4: IOSs reduce uncertainty by inducing a more stable (continuing) pattern of interaction between organizations.

A greater commitment (and thus a stable relationship) results in systems that generate switching costs. American Hospital Supply's ASAP system is a well known example. In general, proprietary IOS linkages are more likely to build in switching costs because they provide services that cannot be obtained elsewhere. Thus, proprietary systems tend to induce more stability and reduce inter-organizational uncertainty.

On Environmental Assessment

In the organizational theory literature, there have been two major approaches to the significance of the environment and its effect on organizations [1]. One approach relies heavily on theories of perception, cognition, and decision-making, focusing on environments as seen through the eyes of organizational members. The environment thus consists of information serving as a raw material and acted on by sentient actors. A special concern of researchers adopting this perspective is the impact of uncertainty on the ability of organizational

participants to make decisions, and on subsequent organizational restructuring to cope with uncertainty.

A second approach treats environments as consisting of resources, for which organizations compete, with the level of resources and the terms under which they are made available being the critical factors in organizational change. Environmental selection arguments, such as the theory of the firm in microeconomics, assume resources are in the hands of a large number of actors whose individual decisions amount to a collective pressure against organizational inefficiency. An example of the resources approach is the "Resource Dependence" theory. Environmental dependence is defined as the importance of a resource to the organization and the number of sources from which the resource is available, as well as the number, variety, and relative power of organizations competing for the resource [32]. This model suggests that managers dictate organizational survival by either choosing appropriate forms for the prevailing environment or by selecting an environment appropriate for the existing organization.

These two views are predicated on different assumptions about the autonomy of actors, on concern with different stages of the process of organizational change, and ultimately on differences about the appropriate level of analysis in studying organizations (individuals or aggregates). Aldrich [1] suggests that the long standing opposition between the information and resource perspectives is reflected in the several disciplines concerned with organizational theory. Psychologists and social psychologists have written largely from the information perspective (Burns and Stalker [6], Sherif [37], Fiedler [14], Weick [42], Williamson [44], March and Olsen [23], Galbraith [15], Argyris and Schon [3], Kotter [20], Mintzberg [26]). The work of Burns and Stalker [6] probably best exemplifies the thinking of sociologists favoring the information view. On the other hand, recent work, especially in industrial organization economics (Caves [10]), has been written mostly from the resource perspective. Recent sociological studies have also taken the resource track (Pfeffer and Salanick [32], Hannan and Freeman [17], and also Perrow [30]).

An attempt to reconcile the two views is made by Lawrence and Dyer [22]. The authors characterize environments according to: 1) the degree of resource scarcity, and 2) information complexity. They analyze the impact of these two dimensions on innovation, efficiency and member involvement, in a process they call "readaptation."

The Information Model

The "Information Model" considers the environment as a source of information. This information view is pertinent to IOSs because IOSs are designed to handle information flows exchanged between an organization and its environment.

Researchers who have viewed the environment as a source of information for organizations have analyzed it along two fundamental dimensions: 1) *complexity* and 2) *changefulness* [1, 6, 12, 13, 21, 22, 40].

- The *simple-complex* dimension describes the number of important environmental components that impact on the organization, that is, the number of suppliers the organization must coordinate to produce output (products, goods, or services), the number of different customer groups that are target markets, and the number of competitors that supply similar outputs.

- The *stable-unstable* dimension describes the changing nature of the environmental components: new government regulations, new or changing suppliers and customer demands, and technological improvements and innovations.

Complexity and changefulness in the environment are seen as sources of uncertainty for the organization. According to Duncan [12], perceived uncertainty is lowest in environments that are both static and simple, and it is highest in environments that are dynamic and complex.

The link between uncertainty and information is made by Galbraith [15] in his information processing model of organizations. He postulates that uncertainty increases the amount of information that must be processed during the execution of a task. Galbraith hypothesizes that organizations have limited capacities to process information and adopt differing organizing modes to deal with uncertainty. In order to see how information is related to structure, he creates the mechanistic, bureaucratic model of organization and follows its development when it is faced with increasing task uncertainty. In response, Galbraith articulates five organizing modes which either reduce the amount of information or increase the capacity of the organization to process more information. The modes that reduce information are: Environmental management, creation of slack resources, and creation of self-contained tasks. The modes that increase processing capacity are: investment in hierarchical information processes (vertical information systems) and development of lateral decision processes.

The information model for IOS environments is based on Galbraith's approach to task uncertainty. The proposed model considers dealing with the environment as the main task of an organization. As Galbraith suggests, uncertainty increases the amount of information that must be processed in the execution of the task. IOSs are seen as strategies that help in the task of dealing with environmental uncertainty by increasing the organization's capacity to process information.

Proposition 5: Even if IOSs do not reduce uncertainty, they can, when interfaced to internal information systems, help firms in processing the increased information needs of uncertain environments.

If the two preceding propositions are true (i.e. IOSs can reduce environmental uncertainty; or, at least, IOSs can increase the capacity to process the greater information of uncertain environments), then it seems that IOSs should be attractive for environments with high uncertainty. The two determinants of uncertainty found in the organization theory literature (complexity and changefulness) suggest the following two propositions:

Proposition 6: IOSs are attractive for firms with complex environments (large numbers of customers, suppliers, etc.).

Proposition 7: IOSs are attractive for firms in changing environments.

The economics of IOSs support proposition 6. IOS development costs can only be justified when transaction volume is large (e.g. a large number of customers or suppliers). An example of a complex environment is that of General Motors, whose IOS network reaches 10,000 suppliers.

It should be noted that proposition 7 seems to contradict proposition 2. The latter has been developed under the assumption that a formal relationship exists between the IOS participants. The formal relationship is more likely to take place in a stable environment (the "deterministic view"). Proposition 7, in contrast, has been developed on the basis of the information needs required to operate in a changing environment (the "information processing" view). Since these

information needs are high, an IOS can facilitate and speed up the task of gathering and processing the required data. Obviously, if the degree of environmental change is such that customers or suppliers cannot commit to a longer term relationship, the chances for IOSs are slim. However, it may still be worth pursuing the relationship (i.e. convince the customer to share in an IOS) as a tactic to induce a stable (interlocking) behavior as proposition 4 suggests (the "proactive view"). The need for interlocking behavior is higher precisely when the degree of change in the environment is high.

Organizational Impacts

The question of how environmental uncertainties impact the organization internally has received a lot of attention in the literature [1, 6, 21, 22, 40]. The conclusion of most researchers is that the external environment has a considerable impact on an organization's internal structure and processes. Several contingency theories linking environmental characteristics with organizational forms have been proposed [6, 21, 22].

These views would suggest that the characteristics of the IOS environment determine the organizational impact of the IOS. However, this logic is not totally acceptable because IOSs provide organizations with a different way of dealing with the environment. Therefore, the characteristics of the IOS environments alone will not explain differences in internal structure or processes. The internal impact can be understood by looking at not just the IOS environment but also at the task (process) of dealing with the environment when IOSs are used.

In Thompson's view [40], organizations cope with uncertainty by creating certain parts specifically to deal with it, and creating other parts specializing in operating under conditions of certainty or near certainty. Thompson sees technologies and environments as major sources of uncertainty for organizations.

Technology, or technical rationality, represents the state of man's knowledge at any point in time that dictates the kinds of variables required and the manner of their manipulation to bring about the desired outcomes. Technical rationality, as a system of cause/effect relationships which lead to desired results, is an abstraction. It is instrumentally perfect when it becomes a closed system of logic. Since technical perfection seems more nearly approachable when the organization has control over all the elements involved, the organization tries to be relatively closed (as far as technology is concerned) in that it attempts to protect itself from outside threats to its basic task (the "core technology"). Internal strategies for minimizing the impact of the environment on the core technology include buffering, smoothing, forecasting, and rationing (Thompson [40]).

It is worth noting the correspondence between Galbraith's organizational modes [15], which reduce the amount of information to be processed and Thompson's strategies [40], which buffer the firm's technology from the environment. By reducing the amount of environmental information that has to be processed, firms automatically reduce (minimize) the effects of external demands on their technologies (as fewer exceptions are called for). Thus, a parallel can be drawn between slack resources (Galbraith) and buffering (Thompson); and, also, between environmental management (Galbraith) and smoothing or rationing (Thompson).

But, what happens when technology-buffering strategies (e.g. slack resources, environmental management) are not used or cannot be used? Then the core technology is left unprotected,

creating a series of conflicts and tensions for making it more responsive (flexible) to the needs of the environment. These conflicts can be constructive if they promote a critical inquiry into organizational policies and practices and lead management to review them when required. The Japanese just-in-time (JIT) manufacturing technique is based on the principle that the withdrawal of buffer-inventories leads to constructive conflict and this, in turn, to total quality control. The ideal is to make one piece just in time for the next operation. Schonberger [38] explains it:

> "A worker makes one piece and hands it to a second worker whose job is to join another piece to it; but the second worker can't make them fit, because the first worker made a defective part. The second worker wants to meet his quota and doesn't like being stopped, so he lets the first worker know about it right away. The first worker's reactions are predictable: he tries not to foul up again and tries to root out the problem that caused the defective part. The typical Western way, by contrast, is to make parts in large lots. A whole forklift-truck load: two weeks' worth, maybe. The second worker might find 10% to be defective, but he doesn't care. He just tosses a defective part into a scrap or rework bin and grabs another. There are enough good ones to keep him busy, so why complain about defectives?"

Flexibility is an important feature of JIT. When one worker in an assembly line is having problems and experiencing delays, others move in to help, partly to avoid being idled themselves. Workers are cross-trained so that they can handle a variety of tasks and can be transferred from one line to another as model mix changes. This flexibility allows JIT to respond more quickly to environmental changes. In the end, both better quality and greater flexibility are the main benefits of JIT.

Implications for IOSs

One of the basic effects of IOSs is the speed of information availability. This creates pressures for quicker organizational responses to the environment. Thompson's strategies of buffering, smoothing, forecasting and rationing are intended to protect the firm's "core technology" from environmental fluctuations [40]. The use of IOSs works against these strategies. Thus, IOSs pose a threat (or a challenge) to the "core technology" because they tend to leave it unprotected or un-buffered from the environment. As a result, the core technology has to change and become more flexible in order to exploit the possibilities that IOSs bring about (e.g. better service, quicker delivery). Thus,

Proposition 8: The use of IOSs creates a need for greater flexibility in operations (production, delivery capabilities).

Stern and Kaufmann [39] found that, despite its beneficial effect of reducing lead times, IOS's faster communication generated some conflict "especially when distributors are informed instantaneously that a deal item they've ordered cannot be immediately shipped or that backlog difficulties have occurred." This conflict reflects the need for greater flexibility when an IOS is in use. Conversely, it can be hypothesized that firms that already have a flexible technology will consider IOSs as an extension of (or as a way to exploit) their ability to respond quickly to the environment.

Proposition 9: Firms with flexible production systems are more likely to adopt IOSs.

Although the correlation between the use of IOSs and flexibility in core technology may seem clear, it is not so obvious which comes first. To a great extent, this depends on the strategic orientation of the firm. Just-in-time production, for example, is a manufacturing strategy that tries to adapt itself to (instead of isolating itself from) the environment. In this sense, it is a flexible "core technology." When used for JIT, IOSs are a natural extension of the firm's strategy. Examples in the automobile industry support this view. For example: suppliers for General Motors' highly automated Buick City in Flint, MI (patterned after Japan's Toyota City) were told to be prepared to accept orders electronically to meet the goal of replenishing inventories once every four hours. However, when a firm develops an IOS myopically (e.g. imitating other firms in the industry, but without having a strategic plan), it may not realize the subsequent demands the IOS imposes on its "core technology."

Apart from the impact on the organization's "core technology," IOSs may impose demands on other parts of the organization. Different task environments may require different strategies, and these, in turn, may require different organizational structures and processes. Lawrence and Lorsch [21] studied how environmental uncertainties impacted the organization. The authors developed the concepts of "differentiation" and "integration"[1] and hypothesized how the organization's environment would interact with them. Their hypothesis suggests that as the external environment changes, and the uncertainty and time span for receiving feedback increase, internal differentiation will also increase. Furthermore, differentiation and the need for integration are directly related. The main conclusion from Lawrence and Lorsch's research is that the external environment has a considerable impact on an organization's internal structure and processes. A potential research question is: do IOSs increase or decrease the need for differentiation and integration?

The answer to this question depends, in part, on the organizational role of the IOS: does the IOS represent a major strategic move? Or, is it just a change in a particular process? Cash and Konsynski [9] suggest that IOSs impact three distinct organizational areas: 1) structure and strategy; 2) skills and staff; and 3) business processes. According to them, the sequence of organizational changes varies depending on whether the company is the initiator or implementor of the IOS, or whether it is reacting to an IOS implemented by another company. Using Miles and Snow's [25] strategic types,[2] the following sequence of organizational changes can be hypothesized:

Proposition 10: For a "prospector," an IOS will entail organizational changes in this sequence: 1) Strategy, 2) Structure, 3) Skills and Staff, and 4) Business Processes.

Proposition 11: For a "reactor," an IOS will entail organizational changes in this order: 1) Business Processes, 2) Skills and Staff, and 3) Structure, and 4) Strategy.

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[1] "Differentiation" refers to the differences in cognitive and emotional orientations among members of different departments. These orientations are characterized by different goals, different time horizons (short or long term), and different interpersonal relations (task or relationship oriented). "Integration" is the quality of the collaboration among departments, as well as the technique used to achieve this collaboration.

[2] "Prospectors" are organizations which almost continually search for market opportunities, and they regularly experiment with potential responses to emerging environmental trends. These organizations often are the creators of change and uncertainty to which their competitors must respond. "Reactors" are organizations in which top managers perceive change and uncertainty occurring in their organizational environments but are unable to respond effectively. These organizations seldom make adjustments until forced to do so by environmental pressures.

Typically, "prospectors" are large corporations who develop proprietary networks and invest in their own communication facilities. These firms are normally leaders in their industries; e.g., General Motors in the automobile industry, Sears Roebuck in retailing, McKesson in drug distribution, American Hospital Supply in hospital supplies distribution, Mead Data Central in electronic publishing, etc. Due to the massive investments required to develop them, these IOSs are the result of top-management's strategic decisions and their implementation tends to be top-down.

Generally, simple IOS participants (firms that access the network, but have no management nor development responsibility for the network) tend to be "reactors." These firms do not take the initiative. Instead, they react to the offerings of another company (the IOS developer); and, usually, their investment is small. Also, the organizational impact is lower. Customers and/or suppliers of GM, Sears, AHS, Mead Data are examples.

The differences between "prospectors" and "reactors" are the result of their different attitudes to IOS adoption. For a "prospector," the IOS is the result of a pre-established strategic plan (strategy in Andrews' terms [2]). For a "reactor," IOS participation is more the result of incremental decisions in reaction to environmental trends (more in the sense of Quinn's "Logical incrementalism," [36]).

Inter-organizational Coalitions

One of the strategies for reducing environmental uncertainty is the creation of coalitions. IOSs can be looked at from a perspective of coalition formation; an IOS is the result of joint choices by participants (different organizations with different goals) whose interests are partially, but not completely, opposed. The president of a medium-size health care organization once told me that he used to see his suppliers as adversaries. The possibility of setting up an electronic linkage with one of his suppliers was making him, he said, change his view. In the future he would look at the relationship with his supplier as a sort of coalition.

Wahba and Lirtzman [41] have formulated and tested a theory of organizational coalition formation. They feel that organizational coalition formation should be placed in its proper organizational context. Certainty and uncertainty have been identified as relevant environmental variables. Organizational coalitions formed under conditions of certainty or uncertainty have had these conditions taken into account relative to their success [29]. Under conditions of certainty or uncertainty and considering the expected utility of the coalition for each member, the probability of coalition success can be calculated. According to Wahba and Lirtzman, coalitions are formed to maximize the expected utilities, and coalitions with the highest expected utilities are the most likely to be formed. Coalitions, they say, may result in a definition of the market share size, pricing policy, territorial considerations, and so on. Their study provides further verification that organizations, regardless of the present degree of environmental uncertainty, tend to act to increase the level of operational certainty and to reduce the amount of uncertainty present in the environment.

Although participants can jointly benefit from an IOS, different types of systems may favor each participant differently. Hence, IOS participation brings about elements of both conflict and cooperation. Cooperation can raise the joint utility, but then the conflict is over the division of this joint benefit between participants. The division of benefits due to cooperation is a bargaining process that has no clear solution. Several economists propose an equal division of the joint benefits among the participants as the fair solution [18, 19, 27, 45]. However, it is easy

to imagine that, in practice, an uneven distribution of the power held by participants may lead to more biased solutions [33, 35, 43].

Game theory is a pertinent reference discipline for studying IOSs from the standpoint of coalition formation. Bakos [4] asserts that IOSs exhibit the essential characteristics of a game-theory situation: "at least two organizations with different goals and objectives are involved and it is the result of joint choices, thus establishing strategic interdependence; and the interests of the participants are partially, but not completely opposed, as they can jointly benefit from a system, but different types of systems favoring different participants are possible, and hence both elements of conflict and cooperation are present."

Implications for IOS Success

The preceding section suggests that the division of the joint benefits of IOSs is a bargaining process that has no clear solution. On the one hand, an equal division of the joint benefits among the participants seems a fair solution; but, on the other, the relative bargaining power of IOS participants may lead to different outcomes.

According to Wahba and Lirtzman [41], coalitions are formed to maximize the expected utilities, and coalitions with the highest expected utilities are the most likely to be formed.

Combining these views:

Proposition 12: IOSs with the highest expected joint utility and a "fair" redistribution of joint benefits (among participants) are the most likely to be successful.

It should be noted that success here is taken to indicate absence of conflict (or agreement by the involved parties) on the terms under which the IOS will be developed and operated.

EDI systems provide an example in support of the preceding proposition. One of motivations behind EDI systems is the reduction of clerical costs through the elimination of paperwork (business documents). This is something that benefits both the supplier and the customer; or the IOS developer and the IOS participant. Business transactions involving a lot of paper and clerical work figure among the oldest and most successful applications. In these cases, the joint benefits are high and the redistribution of benefits is fair and clear for all participants. Trade associations for the industries most heavily involved in the exchange of documents across company boundaries became EDI's prime movers. An example is the grocery industry, where profit margins of a fraction of a percent are common, and, therefore, cost containment is critical. It is calculated that 100 million messages are exchanged yearly among grocery distributors, manufacturers and brokers. A grocery chain in California trades purchase orders and invoices using EDI and it reports savings of 0.1% of its annual sales, which is about $1.6 million annually.

An implication of the preceding proposition is: if the IOS tends to benefit only one of the participants (e.g. the developer), this participant will have to pass some of the benefits to the other participant(s) to get him/them to cooperate (assuming an even distribution of power). For example: American Hospital Supply (AHS) used economic rewards to get hospitals to link to their order entry system. If a group of hospitals was willing to link to the system and purchase a fixed minimum volume of products per year, AHS would guarantee that future price increases would not rise above a preset ceiling.

However, as Porter [35] says, the division of joint profits is a function of the relative bargaining power of participants (i.e. an uneven distribution of power is likely to lead to an uneven distribution of joint benefits). A corollary of this observation is:

Proposition 13: IOSs linking participants with significant differences in their relative bargaining power are more likely to be successful.

This suggests that, if the power distribution is not uniform, the weaker party(ies) to the inter-organizational relation can be forced to participate with minimal or no compensation in return (i.e. the powerful actor, presumably the IOS sponsor, can dictate IOS participation to the other members). An example: General Motors set the June 1, 1985 deadline for its 10,000 most essential suppliers to be prepared to accept orders electronically. As of 1986, suppliers would not communicate with GM unless they sent their business transactions electronically. GM suppliers were in a much weaker bargaining position because of their smaller size and also because most of their output was produced exclusively for GM. This case provides an example where an IOS is successfully imposed on other participants in an environment where the power distribution is unbalanced.

Conclusions

The field of inter-organizational systems is a new one, and, as such, it lacks formal theory. Using Organization Theory as a reference discipline, this paper contributes to filling the theoretical void. The findings reported in the literature are used to address three research questions:

1. What are the organizational environments appropriate for IOSs?
2. What is the intra-organizational impact of IOSs?
3. What are the IOS success factors? A series of propositions addressing these research domains is developed. Although the propositions are not intended to be an exhaustive test, they reflect how the findings in the literature can contribute to IOS thinking.

In addressing the first question, three IOS environmental models are proposed: the "deterministic," the "proactive," and the "information processing" models. The deterministic model presumes the existence of inter-organizational relations prior to IOS adoption and "predicts" the use of IOS based on the characteristics of the inter-organizational relations. According to the model, IOSs will be used in stable environments and also in inter-organizational relations with a high degree of formalization, resource commitment, frequency of interaction, and standardization. The proactive model sees IOSs as a means of controlling the environment. According to this model, IOSs will be used by organizations that want to affect their task environment. A typical strategy for reducing environmental uncertainty is to induce interlocking behavior (e.g. through switching costs). The information model sees the environment as a source of information and views IOSs as an aid for processing the environmental information. According to this model, IOSs are appropriate for environments with high information complexity.

The question of organizational impact considers the effects of IOSs on the "core technology" and the magnitude and order of impacts on other organizational areas (i.e. strategy, structure,

staff, and processes). The need for greater flexibility is the major proposition in the technology domain. The impact on other areas depends on the strategic orientation of the organization ("prospector" versus "reactor" strategic types).

Finally, the question of IOS success is considered from an inter-organizational coalition perspective. A high joint utility and a fair redistribution of joint benefits are suggested as success factors for the IOS coalition. However, it is also suggested that the relative balance of bargaining power may be a more important factor for IOS success than a fair redistribution of joint benefits.

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