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# Developing an Understanding of Interorganizational Systems: Arguments for Multi Level Analysis and Structuration Theory

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# Developing an understanding of interorganizational systems: Arguments for multi level analysis and structuration theory

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***Abstract*-Strategies and policies for the adoption and development of interorganizational systems require further understanding of the theoretical background to these systems. An argument is made for development of theory that is multi-level, processual and has an emergent perspective. Such theory is needed to deal with a context where environmental influences are important in addition to complex interactions between organizational activities at the micro-level and industry structure at the macro-level. The use of structuration theory as a vehicle to advance further understanding is explored. An illustration is given of application of this theory in the development of supply chain management in the beef industry.**

## I. INTRODUCTION

With developments in telecommunications there is an increasing trend for information systems to span boundaries between countries, organizations and the relatively separate components of large, geographically dispersed corporations. These *interorganizational systems* (IOS) include electronic data interchange (EDI), supply chain management (SCM), electronic funds transfer, electronic forms, electronic messaging, and shared databases [1]. Such systems provide the foundation for electronic business (e -busin ess) -- a matter of great economic concern in today' s world.

A number of questions arise concerning strategies and policies for the adoption and development of interorganizational systems. What conditions within an industry or organizational grouping pa rticularly favour adoption of e-business? What are the points of leverage that can be exploited to help an industry in the introduction of e - business? Why have certain industries been able to adopt e - business technologies to reform supply chain management while others have not? Yet when we try to turn such questions into research agendas we are hampered by the lack of theory that can account for action at this broad level of analysis. Interorganisational systems research has dealt with the issues that aris e when systems cross -corporate boundaries, the difficulties of partnerships, and so forth. This research, however, has focused on interorganisational interactions to a limited degree.

Action research projects in which the authors are engaged have indicat ed the need for theory to assist with answers to the questions asked above. In the apparent absence of a suitable theoretical base we have turned first to other empirical work to identify apparent influences on the development and use of interorganization al systems – with the aim of identifying forces and activities that appear to either encourage or inhibit the development of interorganizational systems. These empirical studies suggest that multi-level analysis is needed to deal with the problem.

In particular, it appears theory is needed that includes *industries* or *industry-clusters* as a unit of analysis, as well as the enterprises within the industry. Theory is needed that encompasses the activities of a large group of firms and support organisations, which includes firms in the direct value chains, infrastructure providers, regulators, and trade organisations that have a business interaction focussed on a particular product. The theory also needs to encompass the forces in the external environment tha t act on the industry and the enterprises within it.

Using the terminology of [2], we expect that theory needs to be developed that is mixed -level, in that the problem requires analysis at several different levels – both macro and micro. At the macro -level, we need theory that considers the "industry-as -a whole" as a unit of analysis. For example, when we consider the impact of external forces on the industry we are considering the industry as an entity with properties and behaviour of its own – such as the price of its products or a response to legislation. At this level the relationships that characterize the structure of the industry appear to be particularly important. At a lower level we can look at the properties and behaviour of the individual e nterprises that constitute the industry. Iacovou and Benbasat' s study [3] of the adoption of electronic data interchange by small firms, with the individual firm as the unit of analysis, is an example of a study focusing on this level of analysis. It wou ld be

possible also to focus on a lower level of analysis, the behaviour of individuals within enterprises, if needed.

The paper proceeds by first presenting prior work that is relevant to our questions of interest and the differing viewpoints and levels of analysis that need to be encompassed in theory. Implications for underlying theory are then discussed at a meta-theoretical level and attention given to potential candidates for a theory that encompasses and explains previous findings. The field of interest is large and the activities and interrelationships involved are complex. It is possible that the attempt to identify a single theory with coverage of this large and multiple-layered area is too ambitious. Nevertheless, we identify structuration theory as a potential candidate [4]. The application of the theory is illustrated using one of our action research projects - a case study of the Australian beef industry. The paper concludes with an evaluation of the application of this theory and suggestions for further work.

## II. VIEWS TO BE ENCOMPASSED IN IOS THEORY DEVELOPMENT

Before considering the theory that is needed for IOS we review some previous relevant work including some empirical findings. The review of empirical work is not exhaustive. The aim is to present some representative work that indicates the scope of the problem area.

We found that consideration of different levels of analysis is needed when collating the results from previous studies. We have found it necessary to distinguish two levels of analysis: (1) the industry, and (2) the enterprises within the industry. At the macro-level, the industry as a unit of analysis has properties such as the existence of coordinating bodies and standards and the number of players in the industry. This level of analysis is equivalent to a *collective unit* as defined by [5]. Relationships among enterprises can also be considered as part of the "structure" of the industry and an attribute of the industry as a whole. At the micro-level, the enterprise as a unit of analysis has properties such as size, financial status, and technical infrastructure. It is expected that some attributes of the entity at the macro-level will be related to the attributes of entities at the micro-level. For example, whether an industry has achieved "critical mass" in its level of Internet use is related to the number of individual enterprises that are connected to the Internet. Activities by the entities at the micro-level may affect the entity at the macro-level, and vice versa.

Our discussion proceeds by structuring analysis of previous work under three different headings which we have termed "views". These views are:

- the external view (considering pressures from outside the industry),
- the industry-level view (considering the structure of the industry as a whole, including relationships within the industry, and the existence of coordinating bodies and standards),
- the individual-enterprise view (considering attributes and activities of the individual enterprises, such as the readiness of individual enterprises for SCM).

It is noted that it may be difficult to distinguish the boundaries between these different view points. For example, the extent of a particular industry may not be clear. The processing of hides and leather may be considered either as part of the beef industry or as a separate industry. Fig 1. illustrates the three different views.

### A. *The External View*

It is expected that a number of pressures in the external environment will influence an industry as a whole and also the enterprises within an industry. Turban, McLean and Wetherbe [1] categorize the business pressures acting on enterprises as (1) market, (2) technological and (3) societal. Market pressures include global competition and consumers who are becoming more demanding. Technological pressures include technological innovations and obsolescences. Societal pressures include government regulations, government deregulations, and economic conditions.

Changes in the remote environment can destabilise existing industry structures and routines and create the opportunity for new ones. For example, a government policy in Australia, the "Button Plan", aimed to radically improve the efficiency of the Australian automotive industry. This policy led to profound changes in relationships among players in that industry, including improved cooperation between assemblers and parts suppliers, creation and strengthening of trade bodies, a unique uniform industry-wide approach to electronic commerce, creation of a niche for a government VAN, and near 100% EDI compliance of all trading partners [6,7]. The interactions between the external environment and the industry can be bi-directional. An industry as a whole, or a body representing the industry could act so as to influence government regulations, and thus change the environment within which the industry operates.

### B. *The Industry Level View*

The structure of an industry at the industry level is important, as evidenced in the presence or absence of relationships among players in the industry, whether formalized or unformalized. In addition characteristics of the structure, such as the adoption of messaging standards, a critical mass of Internet-enabled enterprises, and the interconnectivity of software available in the industry are of interest. The existence of bodies such as regulatory or coordinating bodies are also included here as an element of the structure of an industry.

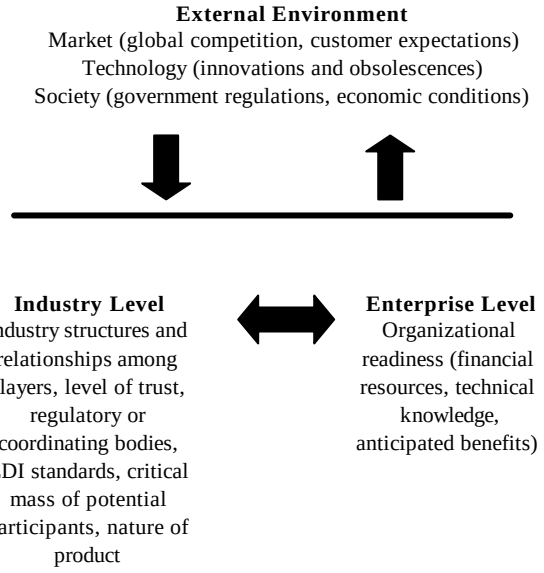


*Fig. 1. Three inter-related viewpoints on the influences on IOS*

Table 1 shows relationships among units that can be considered at an industry level. This list is not meant to be exhaustive but rather to present the richness of the relationships that exist between the entities in a broader industry group. The mapping of the relationships present in a particular industry, and their strengths, would be an important part of understanding industry-level activity in that industry. Some of these relationships taken in aggregate may indicate the *maturity* of the industry structure as a whole in terms of its readiness for participation in IOS and e-business.

Two examples are given to illustrate the importance of considering these relationships at an industry-level when developing an understanding of IOS.

The first example shows the importance of cultural or normative relationships in the industry structure, in particular the role of regulatory bodies. Cameron [8] studied the use of EDI in the Australian international trade and transport community. She found that the Customs Department was successful in implementing its Electronic Initiatives Strategies due in part to its position as a regulator. Customs' ability to mandate provided an initial critical mass of EDI users. This study also concluded that successful implementation of EDI and electronic commerce demands co-ordination of 'volunteers' and all players must achieve a win-win outcome. There is a need for formal facilitation and experienced facilitators, such as those that can be provided by industry coordinating bodies.

A second example shows the influence of power in relationships in industries. Vermeer and Veth [9] considered interorganizational data integration in a study of ten different central database initiatives – almost all of which suffered from lack of support. They concluded there were two important reasons for lack of success: first, political reasons such as hidden agendas and disruption of the balance of power and second, the large number of data fields resulting in large data administration costs and lack of flexibility at a local level. Competitors had hidden agendas because they were not happy about sharing information.

### C. *The Individual-Enterprise View*

Attributes of individual enterprises that appear relevant to engagement in IOS include size, financial resources, technical sophistication, and perceived benefits. Iacovou and Benbasat [3] found a moderate relationship between perceived benefits and EDI adoption and integration. Cameron [8] in her study of the Tradegate projects found that although costs of EDI-enabled software and transmission were reducing, low volume users and small enterprises continued to find EDI implementation expensive.

TABLE 1

RELATIONSHIPS CHARACTERIZING INDUSTRY STRUCTURE

| |
|---|
| *Trading relationships* |
| These relationships centre on adding value to the industry's focal products. |
| *Communicative relationships* |
| Organizational units transmit information concerning actual or planned trading events to certain other units in order to coordinate action. |
| *Economic Relationships* |
| There are a number of possible economic relations between organizational units: competition, cooperation, intermediation. |
| *Corporate Relationships* |
| The behaviour of organizational units may be coordinated by being part of the same corporate entity and subject to its management control. |
| *Power Relationships* |
| Certain firms can influence the behaviour of other firms by threats or sanctions. Such dominance may be based on size, degree of connectedness with other units, security of value adding niche, and so forth. Trust, which is often talked about in the context of interorganisational systems [10], is part of this dimension. |
| *Cultural, Normative, or Sense-Making Relationhips* |
| Firms are influenced by other firms through appeals to notions of "good practice". The influence may be tacitly shared or formalised by certain regulatory units such as industry funded trade bodies or communications standards bodies. |
| *Geographical and other physical relationships* |
| Geographical connectivity and proximity is particularly pertinent to interorganisational reforms in the distribution of material products, such as Just-In-Time replenishment. |

## III. META-THEORETICAL CONCERNS

Before considering the theory that is needed in developing understanding of IOS a number of meta-theoretical questions should be addressed. In the discussion above the argument was made that theory was needed that dealt with different levels of analysis: including the macro-level of the industry-as-a-whole and also the micro-level of the separate enterprises within the industry. In addition, and again using the terms of [2], we need to consider the logical structure and causal agency of the theory that is needed.

Logical structure refers to the temporal aspect of the theory – static versus dynamic. Static theories are also referred to as variance theories. They are concerned with predicting levels of outcomes from levels of contemporaneous predictor variables. Dynamic theories are also referred to as process theories and are concerned with explaining how outcomes develop over time. It appears that a theory of the latter type is required to explain the full range of behaviour and the reflexive nature of the activities surveyed in the previous discussion. For example, the achievement of a critical mass of EDI-capable enterprises in an industry needs a process-type theory to explain how, over time, influences such as powerful trading partners affect the take-up of technology among smaller firms, who may then in turn influence events (such as the formation of industry coordinating bodies) that affect further take-up by other enterprises.

The causal agency of a theory refers to the assumptions about the identity of causal agents, the nature of causal action, and the direction of causal influence among the elements in a theory. Markus and Robey [2] distinguish among (a) theories with a technological imperative, that argue that information technology constrains or determines human and organizational behaviour, (b) theories with an organizational imperative, that assume that human actors are agents of social change and can to a large extent control changes enabled by technology, and (c) the emergent perspective that attributes causality to complex indeterminate interactions between technology and human actors. Markus and Robey conclude that empirical research has yielded contradictory findings concerning the technological imperative and limited support to the organizational imperative. Thus, theory of the emergent or situational type appears more promising for IOS, especially given the complex context of IOS.

In summary, we conclude that theory for IOS needs to include multi-level units of analysis, to be a process theory so as to explain the dynamics of behaviour over time, and to be an emergent theory, treating causal behaviour as arising from an interaction between technology and human actors. In addition, our review of prior work showed that theory must encompass influences in the external environment as well as those acting at the industry and enterprise levels and that influences acting between the units at different levels of analysis can be bi-directional.

There appear to be few candidates for such the ory. A number of theories of the type required, such as organizational politics [11] and organizational culture [12] do not provide for the multi-level analysis required. In this paper we propose structuration theory as a vehicle for greater understanding of IOS. In the next section basic tenets of structuration theory are presented and some implications for IOS advanced. The theory is described only in broad terms here due to space constraints. A fuller account can be found in [13].

## IV. STRUCTURATION THEORY AND IOS

Giddens [4] formulated a meta-theoretical social framework of *structuration theory* that argues that action and structure operate as a duality, simultaneously affecting each other. Giddens defines structure as ‘ rules and resources recursively implicated in social reproduction; institutionalised features of social systems have structural properties in the sense that relationships are stabilized across time and space” [4, p xxx1]. Structure ‘ exists only as memory traces, the organic basis of human knowledgeability, and is instanciated in action.’ [4, p 377] “Resources (focused by significance and legitimation) are structure properties of social systems, drawn on and reproduced by knowledgeable agents in the course of interaction.” [4, p. 15]

Structuration theory has been applied in the field of information systems by a number of researchers [14]. Orlikowski [15] developed a structurational model of technology that describes technology as both constituted by human agency and constituting human practice.

Rose [16] describes further structuration concepts, apart from the duality of structure and action, that help to explain information systems practice. These concepts include time space distanciation, routinization, and system integration. Time space distanciation involves the “stretching of social systems across time-space, on the basis of mechanisms of social and system integration.” [4, p 377] Routinization occurs when social practice becomes reasonably stable over time and space. System integration means that social practice becomes replicated on a wider scale than face-to-face interactions, becoming systemic across time and space. Information technology may be considered as a material resource that supports information practice which in turn supports a wider set of social practices. It does not in itself embody structure. Rose concludes that an information system (in structurational terms) is a social system (information practice), supported by material resources (information technologies), which are designed and managed by a further social system.

Structuration theory, or structuration-type theory, is attractive as a means of advancing our understanding of the development of IOS. It allows for multi-level analysis, is a

theory of process and has an emergent perspective. This theory allows for the incorporation of the different views that must be considered in development of IOS and also provides a means for handling the complexity of the interactions between the activities of ent erprises, the industry structure and the external environment. It also allows for the reflexivity of these interactions.

From the viewpoint of structuration theory the structure of the industry is constituted by the activities of its component enterprises that are reproduced over time. For example, adoption of proprietary communications standards by a firm compromises communicative relationships. Communication between firms may alter power relationships. Adherence to standards entrenches the power of infra structure intermediaries.

The activities of individual organizational units can be both constrained and enabled by the structure of the industry. For example, compliance to communicative standards with other units (a cultural relationship) enables open e ntry by firms into the communication network, but constrains the use or development of new or individual types of communications by the firm, which may be important to competitive advantage. Activity within the industry can lead to the formation of regula tory or coordinating bodies, which constrain or enable further action through their possession of resources, either authoritative or allocative.

The external environment can be considered as a wider social structure that embodies other actors outside the industry, as well as a structure (embodied in artifacts such as legislation) that represents the replicated social practice of these actors. This external structure in turn both constrains and enables actions at the industry -level. At this level the industry is regarded as an "actor" (and the unit of analysis). The industry has a reflexive relationship with the external environment. The external environment influences the industry and the industry contributes to the structure of this external environme nt. The industry, however, is not necessarily a major influence on this external environment. The structure that represents the external environment is constituted by the activities of many other players.

Our main contention about the dynamics of i ndustry -level activity is that certain types of structural relations tend to be reproduced as a result of the way they constrain and enable the situated actions of individual enterprises. There are a number of ways that "desirable" coordinated industry un it action can be acquired. Industry structures that benefit individual enterprises, especially powerful ones, tend to be confirmed and reproduced. Some aspects of structure, however, which may appear highly desirable to a hypothetical observer, freed from the network of interests of the group members, may be difficult to acquire and reproduce as routine.

An important feature of the kind of routinised activity envisioned here is its robustness. This allows for incremental changes to be adopted and routinise d and to then form the basis of more ambitious changes in a bottom -up fashion. This prediction of incremental change is supported by [17], who gathered data from six intensive case studies and a survey of IOS in the United Kingdom. The results showed an evolutionary path for the development of IOS and inter -firm collaboration.

There is, however, another important way in which industry structural relations can be altered leading to new patterns of activity and states of industry coordination. Changes in th e remote environment can threaten the viability of certain inter -unit relationships. The threat of extinction by inter-industry or foreign competition are two such influences. Changes such as the appearance of the Internet or economic changes such as excha nge rate shifts could so dramatically change the nature and viability of certain types of relationships between firms that new patterns of activity are necessitated. Changes in the remote environment may well be the most powerful causes of change in indust ry level behaviour, given the difficulty of on -going coordinated action in this complex context, and may be a major opportunity for episodes of intervention.

The next section describes a case study in terms of the structuration -type theory described here.

## V. CASE STUDY – SCM IN THE AUSTRALIAN BEEF INDUSTRY

This case study concerns the development of IOS for EDI and SCM in the Australian beef industry. The project reported is funded by a government department with the aim of encouraging electronic commerc e in the Australian beef industry. Initially, the project team is working with a small number of beef producer groups to define their requirements and get some trial methods working. The data we report here was gathered to inform this work.

Meat is said to be Australia' s fourth largest export earner. Australian meat exports consist primarily of beef and their major destinations are countries along the Pacific Rim. About half of Australia' s red meat production is consumed domestically. Beef production is carried out predominantly by many individual producers. The case study shows that engagement in e -business is at a very preliminary stage.

Data concerning the case study was gathered in interviews, from notes of meetings and telephone conversations, from archival sources and from surveys. Data gathering has occurred over a period of more than twelve months, beginning in mid -1998. The archival data gathered, however, concerns a longer period. An attempt was made to identify in the data gathered all instances of variables or events that appear to influence the adoption of electronically -enabled SCM in the beef industry. This process was informed by the conceptual background identified above. The project is an example of action research and characteri stics of this type of research should be acknowledged [18]. Further details of the case study can be found in [19].

Structural properties that appear to influence the development of IOS in the beef industry are summarized under the three differing viewpoi nts given above. The pattern of outcomes and events observed are then presented.

*A. The External View*

Here we consider whether influences in the external environment (market, technological, and societal) are related to the development of SCM. Influences observed include:

*Market influences*. Consumers are becoming increasingly concerned with quality, product convenience, and health issues such as food safety.

*Regulatory influences*. Some electronic feedback along the supply chain eventuated some time a go following the "roo-in-the-stew" fiasco[1]. The European Union will require in the year 2000 that cattle destined for their market are individually identified. This requ irement will encourage greater electronic record-keeping and information passing along the supply chain.

*B. The Industry-Level View*

Under this heading we consider structural properties at the industry level that appear to influence the adoption of EDI and SCM.

These properties include:

*Participation in vertical alliances*. Australia has a number of vertically integrated companies. For example, AMH is Australia' s largest meat processor. AMH has four feedlots, four abattoirs, a domestic wholesale network and a processed food division.

*Level of trust between industry players*. Declines in world prices since 1994 have reduced profit margins for processors. The meat industry is characterized as consisting of oligopolies that are fiercely competitive. Ind ustry sources believe that the processing sector is an inhibiting factor to greater supply chain management. "It' s all about information in this industry and who gets it and shares it and information is power".

Other influences include:

*Presence of coordinating bodies*. A number of bodies exist but they represent different sectors of the industry – processors, producers and retailers.

*Standards for electronic data transfer*. A standard was developed some time ago but it is very poorly supported and not in widespread use.

*Critical mass of e-commerce participants*. Estimates state that only about 20% of beef producers are using the Internet.

*Interconnectivity/availalility of software*. There are many different software and hardware systems in use in processing plants and many different on-farm packages. Few of these systems can "talk" to each other.

These influences show the importance of the relationships listed in Table 1 as characterizing industry structure, and constraining or enabling the activ ities of individual enterprises in the development of IOS.

*C. The Individual-Enterprise View*

Under this heading we consider properties of individual enterprises that appear to be related to the adoption of EDI. These properties include financial resource s, technical capabilities, and perceptions of the benefits of electronically-enabled SCM.

Influences that appear important include:

Enterprises vary considerably in their financial resources. The top 25 per cent of beef properties grossing more than $2 00,000 made a profit of $168,000 in 1996-97 and a rate of return of 6.3 per cent. The average made a $7,000 loss and a 1.1 per cent rate of return [20].

The technical infrastructure necessary to engage in EDT is still not widespread, but is growing. An ABARE survey shows computer ownership by specialist beef properties as 35% in 1996-97 [21]. Around 20% of these properties used a modem for farm management purposes and 47% for e-mail.

Individual beef producers see value in receiving feedback electronic ally. Some data has been obtained from a survey completed by 31 producers. Of the 19 producers who answered a question asking if they would pay to receive feedback, 12 indicated that they would, giving figures from $1 to $10 per head.

*D. Patterns of activities*

Given the conditions described above it is perhaps not surprising that e-business is not commonplace in the beef industry. Outcomes for structure and process in this industry include:

Supply chain management supported by ele ctronic data transfer appears to be occurring mainly in vertically integrated alliances. There is an increasing trend for producers to form themselves into cooperatives. Attempts by these groups to engage in business-to-business e-commerce are thwarted by the lack of standards for data transfer.

Some producer groups are using electronic communication to reduce transaction costs and improve information sharing (internal e-business) [22].

[1] When kangaroo meat was substituted for beef intended for export in the early 1980s.

Significant steps towards business-to-business e-commerce have occurred in response to strong external pressures (such as health and food safety scares). A data dictionary and messaging specification was developed for providing feedback from abattoirs after the meat substitution scandal. After that time efforts to have standards for EDI further developed and supported were not successful. At the present time there is an industry-wide initiative working to develop an industry database for the National Livestock Identification Scheme (NLIS). This project is a response to requirements of the European Union to have imported beef traceable through individual animal identification. The arguments for structuration theory made above have influenced the behaviour of participants in the action research project. The pressure for the National Livestock database appears to provide a good opportunity for intervention. Thus, the team are taking this opportunity to argue strongly that the NLIS should be accompanied by updating and support for the industry standards for EDI, actions that would further enable SCM.

In summary, the beef industry is at a very preliminary stage in adopting e-business. A number of the structural pre-conditions for uptake appear to be missing, such as support for standards for EDI, a critical mass of participants, a single body to represent and facilitate industry action, and a high level of trust among players. Some e-business has developed in vertically integrated alliances or enterprises that include processors, a very powerful sector. This may be due in part to the greater technical expertise of the larger companies and the pressure they can exert on others in the supply chain. Conditions are such that desired practices (the adoption of SCM on a large-scale) can not arise from the "routine" activities of individual enterprises.

The pattern of activities observed in this case study is largely congruent with the predictions made from structuration theory. There is evidence of bottom-up behaviour in the move to use electronic communication among producer groups. Some producer groups are also willing and able to engage in SCM. They are thwarted, however, by conditions in their immediate environment, namely the lack of interest by a powerful sector, the processors. There is no evidence of purposive behaviour at the industry level, apart from that occurring in response to strong external forces.

The observation of activities at the enterprise level supports the use of structuration-type theory to analyse IOS and the need for multi-level analysis.

## VI. Conclusions

From an analysis of the context of IOS and previous empirical work we have argued that theory of IOS is needed that encompasses several levels of analysis in addition to the external environmental forces that influence IOS. Theory is needed to deal with industries or industry groups at the macro-level and enterprises at the micro-level. Relationships among enterprise units at the micro-level help to define the structure of the industry at the macro-level. The relationships that define structure include trading, communicative, economic, corporate, power, cultural and geographical relationships. The interactions concerning IOS among the different levels of analysis and the external environment can be bi-directional.

In this complex and dynamic context, it is argued that theory is needed for IOS that is multi-level, a theory of process rather than a static theory of variance, and a theory that has an emergent perspective, with change viewed as a result of interactions between technology and human actors.

A candidate theory advanced to explain IOS is structuration theory. This theory proposes that action and structure are a duality, simultaneously affecting each other. For IOS, the structure of the industry is characterised by activities (relationships) among component enterprises. Action at the individual firm level occurs in the context of this structure. This industry structure both constrains and enables the development of IOS. In addition, the industry as an entity exists within an external environment. Characteristics of the structure of this external environment also influence the development of IOS. The interactions between the industry and the remote environment and between the industry structure and its component enterprises are reflexive. Structuration-type theory appears to have potential in yielding insights into IOS at a broad level.

A case study of moves towards SCM in the Australian beef industry is largely congruent with a structuration-type theory. Aspects of the industry structure that influence organizational adoption of e-business were identified. Some change has resulted from bottom-up activities, such as the adoption of electronic communication by beef producer groups. Further change is constrained by the immediate environment of the producers – the lack of standards for EDI at the industry level and the power relationships that characterize the structure of the industry, in particular the power exerted by the processing sector which has little to gain from providing feedback along the supply chain. EDI has developed as a routine activity among enterprises linked in vertical alliances. There is no evidence of purposive behaviour towards the adoption of EDI for SCM except in response to strong external forces, such as food health and safety scares. Structuration theory appears lacking in this respect, as it does not offer explanations for the influences of factors that are independent of the social structure (for example, an outbreak of mad cow disease). Further, structuration theory does not appear to offer a detailed account of other influences that may be relevant, such as the intentionality of individual agents or some of the

characteristics of an industry, such as the nature of its products. In such a comple x area it is probable that one single all-encompassing theory cannot be found. Embracing the broader view may be at the expense of micro level mechanisms.

Further work on interorganizational system development is indicated to allow structuration theory to be more critically examined in this context and the potential for other theoretical frameworks to be explored.

REFERENCES


[1] E. Turban, E. McLean, and J. Wetherbe, J. *Information Technology for Management*, (2nd edn.). 1999, New York :Wiley.

[2] M. Markus and D. Robey, "Information Technology and Organizational Change: Causal Structure in Theory and Research." *Management Science*, 34,5, 1998, pp.583-598.

[3] C. Iacovou and I. Benbasat, "Electronic data interchange and small organizations: Adoption and impact of technology," *MIS Quarterly*, Dec., 1995, pp. 465-485.

[4] A. Giddens, *The Constitution of Society*. Cambridge: Polity Press, 1984.

[5] R. Dubin, *Theory Building*, New York: Free P ress, 1978.

[6] D. Mackay, *The Impact of Electronic Data Interchange on the Australian Automotive Industry*, Unpublished PhD. Thesis. Deakin University, Geelong, Australia, 1995.

[7] R.P.W. Lee, *Rationale for Adopting Electronic Commerce in the Australian Automotive Industry*, Unpublished Masters Thesis. Monash University, Melbourne, Australia, 1996.

[8] J. Cameron, "EDI in Australian International Trade and Transport," In *Advanced IT Tools*, N. Terashima and E. Altman, Eds. London: Chapman and Hall, 1996, p p. 236-247.

[9] B.Vermeer and T. Veth, "Interorganizational data integration: Theory and practice," in *Eleventh International Bled Electronic Commerce Conference*, G.J. Doukidis, J. Gricar, and J. Novak (Eds.). Bled, Slovenia, 387-401.

[10] P. Hart and C. Sanders, "Power and trust: Critical factors in the adoptions and use of electronic data interchange," *Organization Science* 8,1,1997, pp. 23-42.

[11] R. Kling (1974). Computers and social power. *Computers Soc. 5*, 6-11.

[12] J. Martin (1992). *Cultures in Organizations: Three Perspectives*, Oxford University Press, Oxford, UK.

[13] R.B. Johnston and S. Gregor. A structuration -like theory of industry -level activity for understanding the adoption of interorganizational systems. This volume.

[14] G. Walsham and C. Han, "Structuration theory and information systems research," in *J. of Applied Systems Analysis*, 17, 77-85.

[15] W. Orlikowski, "The duality of technology: Rethinking the concept of technology in organizations," *Organization Science*, 3,3,1992, pp. 398-427.

[16] J. Rose, "Frameworks for practice – structurational theories of IS", in *Proceedings of 6th European Conference on Information Systems*, W.R.J. Baets, Ed. Granada, Euro -Arab Management School, 1999, pp. 640 - 655.

[17] F. Li and H. Williams, "New collaboration between firms: The role of interorganizational systems", in *Proceedings of the 32nd Hawaii International Conference on System Sciences, 1999*.

[18] R. N. Rapoport, "Three dilemmas of action research," *Human Relations*, 23, 1970, pp. 499-513.

[19] S. Gregor and D. Menzies, (1999). Electronic data transfer and supply chain management: A case study of the beef industry. *Proceedings of the 3rd Annual CollECteR Conference on Electronic Commerce*, Wellington, New Zealand, 29 Nov.

[20] C. Bolt, "Superfarms: the best in the bush," *Australian Financial Review*, October 4-5, 1997.

[21] P. Martin, D.Riley, J. Jennings, C. O' Rourke and C. Toyne, *The Australian beef industry 1998*, ABARE Research Report 98.7, Canberra: Australian Bureau of Agricultural Resource Economics,.1998.

[22] S. Gregor and K. Jones (1999). Beef producers online: Diffusion theory applied. *Information Technology & People*, 12, 1, 71-85.