Association for Information Systems
AIS Electronic Library (AISeL)

ECIS 2000 Proceedings

European Conference on Information Systems (ECIS)

2000

A Theory of Industry Level Activity for Understanding the Adoption of Interorganizational Systems

Robert B. Johnston
University of Melbourne

Shirley Gregor
Central Queensland University

Follow this and additional works at: http://aisel.aisnet.org/ecis2000

Recommended Citation
Johnston, Robert B. and Gregor, Shirley, "A Theory of Industry Level Activity for Understanding the Adoption of Interorganizational Systems" (2000). *ECIS 2000 Proceedings*. 194.
http://aisel.aisnet.org/ecis2000/194

This material is brought to you by the European Conference on Information Systems (ECIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in ECIS 2000 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

search

A Theory of Industry-Level Activity for Understanding the Adoption of Interorganizational Systems

Robert B. Johnston
Department of Information Systems
University of Melbourne
Melbourne VIC 3010 Australia

Shirley Gregor
Department of Computing and Information Systems
Central Queensland University
Rockhampton QLD 4701 Australia

***Abstract*-Increasingly we wish to ask and research questions about the adoption of interorganizational systems and electronic commerce at the industry level but are hampered by the lack of a theory of concerted purposeful action at this large level of analysis. In this paper we give the outlines of such a theory and indicate the uses to which it can be put. Particular attention is paid to how the routine day-to-day activities of the firms and support organizations that make up an industry group can be coordinated in such a way that we can speak of an industry as engaged in purposeful activity. We contend that only through a deep understanding of the possibilities and nature of routine coordinated activity at this level can issues concerning promotion, implementation and adoption of interorganizational systems by whole industries be properly framed.**

I. Introduction

At this stage of maturity of inerorganizational systems (IOS) and electronic commerce (EC) research, one would like to ask questions such as: Why have certain industries been able to adopt electronic commerce technologies to reform supply chain management while others have not? What conditions within an industry particularly favour adoption of EC? What are the points of leverage that can be exploited to help an industry in the introduction of EC? 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. Interorganizational systems research has dealt with the issues that arise when systems cross corporate boundaries, the difficulties of partnerships, and so forth, but has tended to focus on a limited scope of interorganizational interactions, often pair-wise. But what the above questions demand is a theory of the concerted activity of a large group of firms and support organizations, which includes firms in the direct value chains, infrastructure providers, regulators, and trade organizations, who have a business interaction focussed on a particular product.

Discussing purposeful activity at the industry level presents some new theoretical challenges. Although the practice has been criticised [1], in the case of organizational activity it is to some extent possible to associate organizational intentions with those of a powerful individual such as the CEO and to assert that such a person's view of activity can act as a shared view for the organization. Given the discrete corporate identities of the players at the industry level, it is much more difficult to assert that any player's intentions and visions stand for those of the industry group as a whole or that day-to-day practices of individual organizations are in any simple sense mediated by such shared goals and visions. In addition, the organizational group, is at least in principle constituted, to *cooperate* in the achievement of the focal task as a way of achieving certain economies of scale, whereas, in free market economies the fundamental interaction of companies is *competition*. These considerations demand more careful attention to the possibility and nature of concerted purposeful activity at this large unit of analysis.

In this paper we make a start at constructing such a theory of industry-level activity, with the ultimate objective of explaining the diffusion, adoption and operation of supply chain electronic commerce technologies. Space only allows a theoretic exposition: early application of the theory can be found elsewhere [2-4]. We want to make as explicit as possible what the commitments of the theory are and why they have been made. Thus, the method we have chosen is to use the meta-theoretical framework put forward by Markus and Robey [5] to discuss theories of the impact of IS upon organizational change. This allows us to be quite explicit about the logical structure of the theory, its units of analysis and our position on causal agency. The commitments we make are similar to those implicit in Gidden's structuration theory which has become popular recently for discussing implementation of information systems [6-8], but there are important differences. In fact, the theory we present can be thought of as a structuration-like theory applied to organizations as actors within an industry group.

II. Causal Structure of the Theory

Markus and Robey [5] present a meta-theory of theories of information systems and technology driven change in organizations in which they define three principle dimensions of causal structure of such theories. They are:

1) *Causal agency:* which "refers to the analyst's beliefs about the identity of the causal agent, the nature of causal action and the direction of causal influences among the elements in the theory", [5, p585]. They distinguish between types of theories where the locus of causation is the (technological) *environment* or situation, the *focal agent*, or the *interaction* between environment and agent.

2) *Logical structure:* which refers to the degree of extension in time of the relations between cause and effect.

search

They distinguish between *variance theories* (also more recently called factors theories) which are "concerned with predicting levels of outcome from levels of contemporaneous predictor variables" [5, p589], and *process theories* where outcomes are assumed to be more properly determined by the nature of processes that occur over the duration of the change episode.

3) *Level of analysis:* which refers to the type of social entities (individuals, organizations, society, or a mixture of these), which are the main concern of the theory and form the atomic analytical units of the theory.

The theory put forward here is explicitly a *multi-level, interactional, process* theory. These commitments are very much interconnected and are elaborated in the following sections. These dimensional settings essentially define the theory as being of a certain *generic* type. We will also need to specify an additional set of commitments concerning the nature of activity that define it as a *particular* theory.

A. Levels of analysis: analytical units

Since our goal is a theory of the intentional activity of industries, our primary unit of analysis is the industry group. We make the usual split between this unit as a focal actor and its environment. However, to explain concerted activity at the industry level we find it necessary to speak of the situated actions of individual members of this group and how these become coordinated. Therefore, we must include individual firms and organizations as lower level actors in the analysis. Again we make the split between these actors and their environment and find that the latter consists of the broader industry environment plus a more immediate environment consisting of the industry as a whole. We are thus led to a rather unusual three level theory. These analytical constructs are defined thus:

1) *Individual industry* ***units***. These are the firms and organizations that contribute to the operations of the industry. Examples are: firms directly associated with the value chain of the product specific to the industry, that is, manufacturers, wholesalers, distributors, and retailers; infrastructure providers such as transport providers, financial institutions, software providers, and communications providers such as VANs; regulatory organizations such as trade organizations, standards bodies, and industry related research organizations. These firms and other organizational entities are the smallest grain-size entities of the theory. We consider actions and intentions to be attributable to the units rather than to particular persons in them;

2) *The* ***industry group*** *itself.* This consists of the individual industry units *plus* the system of relations between them. These relations, which will be described in more detail below, are what makes the collection of units greater than the sum of its parts, and therefore worth speaking about as an entity to which coordinated activity can be attributed. An important challenge of the theory is to show how industry group action is related to industry unit activity. Since we have included not just the firms directly adding value to the focal product of the industry but also any other organizations supporting these activities, our notion of industry group is rather similar to Porter's notion of "industry cluster" [9]. This industry group is also the **immediate environment** of the individual units;

3) *The* ***remote environment***. This consists of all firms, organization, institutions, and other factors at a larger scale than the industry, that affect the firms and organizations of the industry and the relations between them. Examples are: government policies, economic conditions, competing industries, foreign exchange rates, foreign competition, technological change, physical environment and geography.

The distinction between the immediate unit environment and the remote extra-industry environment needs some clarification. The defining characteristic of the remote environment is that although it constrains and enable certain actions of the industry units, these characteristics are not substantially affected by the actions of these units acting individually or in consort. An example is the appearance of the Internet as a communication technology. Although this has had a great effect on the practicality of EDI in certain industries [10], it would be hard to argue that the actions of any specific industry grouping have shaped the nature of the core design and protocols of the Internet. Such shaping forces occur at a larger scale than particular industries. Another example is government policy which, in the case of the Australian automotive industry, has had profound effects on its adoption of EDI [11]. But these policies were largely shaped by events on the international scale and by ideologies not derived from the automotive industry itself. Finally, the physical environment of the industry shapes what can be done in that industry. For instance, the feasibility of Just-In-Time delivery is affected by geographical remoteness, but is hardly influenced by the industry itself.

By contrast the immediate environment, what is taken to be the industry at large, is defined here to be all those firms and organizations whose actions both enable and constrain the actions of individual firms but are *also themselves* influenced by the industry units through mutual interaction. We will explore the detailed nature of this interaction in later sections. For example, while the nature of the Internet at the large scale is not substantially a response to the needs of particular firms or industries, these needs, and the business opportunities they afford, have directly given rise to certain Internet-based EDI software products [2,10,12]. So such software providers have an effect on the activities of industry firms and are also affected by these activities. Thus they must be considered to be within the immediate environment of the industry units as defined above, and also to be units of the broader industry group. The defining characteristic of the industry group, and thus the immediate environment of the units, that we have in mind is this *mutual* interaction of all the parts, that is, a certain kind of closure by virtue of the

search

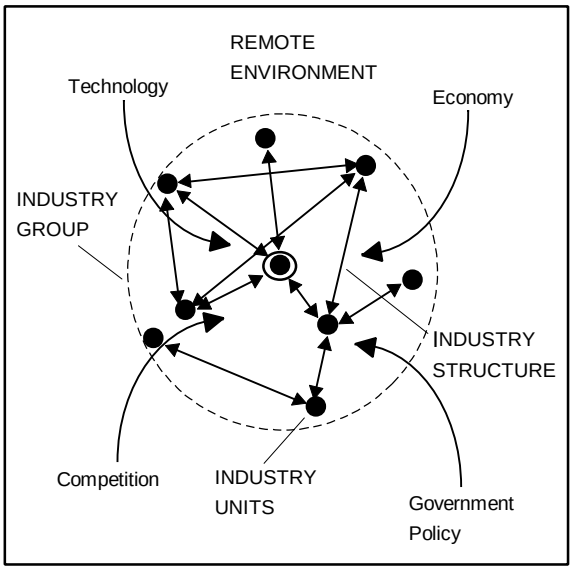

Fig. 1: The focal industry unit acts in an environment of the structures of the industry group plus remote influences.

fact that most of the organizations with which any one organization interacts are also part of the group.

There are some definite assumptions being made here which should be made explicit. By associating the immediate environment of individual firms with the group of mutually interacting units we have assumed that this group of actors and their interactions essentially constitutes the industry. There may well be other types of entities that must be included in a full inventory of the potential influences upon the actions of units but are not industry units as defined. The nature of the focal product of the industry, for instance the need to keep meat refrigerated, might be an example. The assumption that what happens in some domain can be explained in terms of the interaction between actors only, is a consequence of trying to describe the world in intentional terms, and it is not obvious that everything in the world can be conceived of as an actor (cf. actor network theory [13]). Structuration theory also suffers this problem and it is hard to incorporate the aspects of the world that are not social in that theory. We have included in the theory a richer mix of entities in what we term the remote environment partly to overcome this problem. This is possible because of the more passive role attributed to the remote environment.

In addition the boundary between the industry group and its remote environment is somewhat fuzzy. Certain infrastructure providers and standards organizations might not be entirely specific to any industry and yet they are sufficiently influenced by the interests of individual industries to be considered at least partly within its boundary. Within the industry group itself there my be units that deal with the focal product that are so individualistic or monopolistic that they can hardly be said to be in interaction with the rest of the industry. There may be units that are so powerful or so weak that their interaction with other units is hardly reciprocal. There will also be units whose interaction with each other is constrained by corporate ties and vertical integration, such as the distribution and retail functions of large supermarket chains, so what constitutes the actual atomic units of the theory may be open to discussion. Nevertheless, we press ahead with the somewhat simplistic model of the domain of industry-level activity presented above, because we are primarily trying to articulate a conception of how activity at the industry level is related to activity at the unit level and the consequences of this. Whether such a model is rich enough to account for all industry activity phenomena is an empirical question for future research.

B. Causal agency

We take the position that the actions of the industry units are both constrained and enabled by the existence of certain relations between them which form the **structure** of the immediate industry environment. This notion of structure plays a similar role in our theory to that of structure in structuration theory, but is rather more concrete than Gidden's 'rules and resources' which 'exist only as memory traces' and are 'instanciated in action' [14, p377]. Since this industry structure is in turn the product of the actions of individual units, actions of the individual units and of the industry as a group are mutually determining. Thus, individual units are neither entirely unconstrained by the industry as immediate environment, nor entirely subsumed by the industry group as a focal actor. Thus the locus of causal agency within the industry group is the *interaction* between the activities of the individual units and the networks of relations among the group (its structure). Causal agency is thus of the *emergent* type defined by Markus and Robey. However, because we allow for the existence of a remote environment whose influence on the industry units is essentially one way, we allow the possibility that activity of the industry is to some extent technologically (or more properly environmentally) determined in Markus and Robey's sense (for instance, as in the case of EDI in the Australian Automotive industry mentioned above). However, any such determinism is likely to be less linear than in the simple technologically determinist theories described by those authors, because the effect of technology on individual firms in our theory is most likely somewhat indirect via the effect it has on the nature of possible relations between units (industry structure).

C. Logical structure

We now take a position on the nature of activity at the individual and group level which defines the logical structure of our theory as *processual* in Markus and Robey's classification. We assume that what happens at both a unit

and group level is detectable as patterns of coordinated behaviour of units that are reproduced over time. Rather than the trajectory of industry activity being determined at any time by the action of a set of environmental or other factors, we argue that this trajectory is one that is simultaneously consistent with the constraints imposed by the structure of immediate and remote environment and with the principle that this trajectory of activities is what actually *constitutes* the industry structure itself. Thus, in both times of stability and times of change such a trajectory will be difficult to predict from preceding conditions and understanding the conditions of its reproduction will require a deep analysis of the mutual reinforcement of the structure of industry relations and their interaction with the actions of individual units over space and time, that is, a processual analysis [15].

To describe in more detail our conception of the principle of reproduction of inter-organizational activity we need to go more deeply into the nature of industry level structure and our particular notion of *situated action*. This takes the discussion beyond the generic classification of the type of theory we propose, to the specific dynamic commitments of the theory.

III. Dynamics of Industry-Level Activity

A. Theory of Activity

To flesh out the dynamical structure of the theory we now need to take a position on the nature of on-going intentional or goal directed activity in complex systems. Such positions have been termed theories of activity by Agre [16,17]. (This terminology should not be confused with Russian Activity Theory [18]). A number of author's [16,17,19-23] from diverse disciplines have pointed out recently that there are essential two choices for a theory of activity of intentional systems: representational / information-processing theories of activity, and situational / interactional theories of activity. In the first kind it is assumed that the focal agent (which would in our case would be the industry) can act in its environment to achieve desired goal states by means of the construction and maintenance of a symbolic, abstract representation of its environment and its state within it, using data acquired by sensing the environment, and can determine a series of formal actions capable of taking it from its current state to the desired state by a process of logical deduction upon this abstract representation of the world of action. This series of formal actions is a plan, which is then implemented in the real world.

Applied to our problem this would require the industry as a group to be able to construct and share a central and common representation of its position as a group with respect to its environment, and to be able to use this shared representation to deduce and implement an agreed set of coordinated actions. This vision of industry-level activity, as with all applications of this type of plan-based activity theory, would be based on a metaphor of the industry acting as a conscious, deliberative agent, and is implicit in many project management approaches to industry reform. We argue that, although such plan-based, deliberative activity can be organised on rare occasions, it is quite implausible that ongoing, day-to-day activities of industry units are coordinated in this way by reference to a shared representation of their joint intentions and actions. Thus while acknowledging the *possibility* of planned industry action we seek an alternative explanation of how coordinated goal-directed actions of industry units occur and are maintained on an ongoing basis that does not rely on shared plans.

The second type of theory of activity imagines a focal agent with simple, possibly purely reactive, responses to its environmental situation, acting in an environment that is structured in such a way as to tend to enable certain goal outcomes. These outcomes are then as much attributable to the structure of its environment as to the actions of the focal agent. In these theories the focal agent is not required to be capable of forming an "aerial view" of its relation to the environment, but instead acts on the basis of its direct perceptions of the environment from its particular situated "ground view", and can act with distinctly bounded formal reasoning powers because the structure of the environment assumes some of the "cognitive burden" of intentional action [24,25]. Activity is an interaction between the situated responses of the focal agent and the structure of the environment in which it acts, and goal achievement is emergent from this interaction. The metaphor that encapsulates this type of activity is that of *routine* behaviour in familiar situations. Routines [26] are simple actions that are both triggered by situations and supported in their goal achievement by the recurring structure of situations that elicit them.

We take this type of theory of activity to be the likely mechanism of ongoing, routinized industry-level activity. Applied to our problem, we see the trajectory of action of the collection of individual units, that is activity at the industry group level, as composed of a collection of relatively simple, myopic, situated responses of individual units to their immediately perceived environment. However, this environment consists both of the remote uninfluenced environment and the immediate environment consisting of the network of relations among the units. In such a theory it is because the immediate environment is reciprocally determined by the actions of individual units that the collective trajectory of actions of the units can be said to be the activity of the industry group. In other words, concerted activity is attributed to the reciprocal causal effect of the group upon individual units, rather than to any form of regular group deliberation about action. We must now elaborate on the types of structural relationships that can occur in the industry and the way they might enable and

constrain the individual situated actions of the units themselves.

B. Industry Structure

Relations between industry units are influences of one firm upon another that cause their actions to be correlated or coordinated. Defining all such relationships between firms at any time would define the structure of the industry. There are a number of different types of relations and not all individual units or types of units are involved in every type of relation. These include:

1. Trading relations or relations that centre on adding value to the industry's focal products. Essentially, one industry unit is a supplier of goods in such a relation and the other is a customer. Mapping these pair-wise relations defines the supply or value chains of the industry.

2. Communicative relations. Units transmit information concerning actual or planned trading events to certain other units in order to coordinate action.

3. Economic Relationships. There are a number of possible economic relations between units:

Competition. Individual industry units compete *with* other units for customers or suppliers;

Cooperation. Individual units cooperate *with* some units against other units, or to reduce the bargaining power of customers or suppliers;

Intermediation. Some units intermediate *between* supplier and customer. There are trading intermediaries and infrastructure intermediaries. Trading intermediaries add value by transforming the product (manufacturers) or by reducing the cost and risk of trading (distributors, wholesalers). Infrastructure intermediaries (eg. VANs) reduce infrastructure costs and risk for firms.

4. Corporate Relationships. The behaviour of units may be coordinated by being part of the same corporate entity and subject to its management control. For instance distribution and retailing, which we would consider to be separate functions or units of the retail supply chain, are often combined in supermarket operations. Similarly, units may be vertically integrated hierarchically. In either case, economic and power relations will be of a different type and strength than for units in free market relationships.

5. Power Relations 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 interorganizational systems [27], is part of this dimension.

6. Cultural, Normative, or Sense-Making Relations. 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.

7. Geographical and other physical relations. Geographical connectivity and proximity is particularly pertinent to interorganizational reforms in the distribution of material products, such as Just-In-Time replenishment.

This list is not meant to be exhaustive but rather to present the richness of the relations that exist between the individuals of a broader industry group. The mapping of the particular relations present in a particular industry, and their strengths, would be an important part of understanding industry-level activity in that industry.

C. Reciprocity of Industry Group Structure and Unit Activity

The activities of individual industry units are both constrained and enabled by the structure of relations that exists in the industry. For example, compliance to communicative standards with other units (a cultural relationship) enables open entry 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.

Conversely, the structure of the relationships that exists in the industry is constructed from the actions of the individual industry units. 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 infrastructure intermediaries.

D. Reproduction of the Structure of Industries

Our main contention about the dynamics of industry-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 the individual units. If the group structural relations created by the situated actions of individual units are consistent with the possibility of the individual firms performing these actions without undue recourse to deliberative planning, then both the structure and the individual actions will tend to be reproduced over time and more easily become routinized. This explanation of group concerted action does not need to appeal to the sort of explicit deliberative coordination envisioned by representational type theories of activity, and is more consistent with the situated capacities of individual units to act.

The unfolding of the trajectory of the actions of the industry units is thus a complex interplay of interactions of the units with the immediate and remote environment and the tendency of these actions to confirm and reproduce the structure of the immediate industry group environment. Whether this trajectory of action actually fulfils goals deliberately aimed for by individual units or groups of units, or by trade organization that purport to represent the interest

search

of industries as a whole, is thus an *emergent* rather than planned phenomenon under this theory. Goal attaining industry group behaviour is largely achieved by evolution in this theory and is explained by the history of unit-group / structure interactions over time.

There are a number of ways that "desirable" coordinated industry unit action can be acquired. Industry structures that benefit individual units, especially powerful ones, tend to be confirmed and reproduced. Episodes of coordinated group deliberative action are possible as a way of redirecting group action trajectories, but the maintenance of the new trajectory depends on the mutual reproduction of new industry structures by the new possibilities they afford for situated actions of individual firms. Because of the proposed myopic, self-satisficing nature of normal on-going unit action, certain trajectories of group action which may appear highly desirable to a hypothetical observer, freed from the network of interests of the group members, for instance ones that lower total operating cost substantially through coordinated group activity, may be difficult to acquire and reproduce as routine. This is because according to this theory such a transcendental, "aerial view" of activity is not generally available to the industry as a group, and is not part of the principle of reproduction of group activity. It is even possible that individual activity that is dysfunctional for group survival could be reproduced for a while. However, perception of a threat of extinction by units or groups of units would be a powerful means by which situated firm actions could be changed in such a way as to disconfirm such dysfunctional industry structure and result in the evolution of new structure.

The prospect for desirable change is not as dismal as it may seem from the above description. An important feature of the kind of routinized, situated activity envisioned here is its robustness. This allows for incremental changes to be adopted and routinized and to then form the basis of more ambitious changes in a bottom-up fashion. In terms of planned change, such an image of incremental routine-stabilised change holds out a promise for making better use of difficult deliberative action episodes than a notion of interorganizational change based entirely on deliberative planning.

However, there is another important way in which industry structural relations can be altered leading to new action trajectories and states of industry coordination: this is through the effect of changes in the remote environment upon the viability of certain inter-unit relations. The threat of extinction by inter-industry or foreign competition has already been mentioned. Technological changes such as the appearance of the Internet or economic changes such as exchange rate shifts could so dramatically change the nature and viability of certain types of relations between firms that new trajectories of situated activity are reproduced by the changed structures. Changes in the remote environment may well be the most powerful causes of change in industry level behaviour, given the difficulty of on-going deliberative coordinated action, and may be a major opportunity for episodes of intervention.

IV. Discussion: Implications of the Theory

A. Implications for explanation of change

The theory presented here has a number of important implications for the explanation of the nature of change and the feasibility of controlled change of industry level coordinated behaviour. Firstly, contrary to simplistic deterministic factors theories, there is no simple relationship in this theory between a set of environmental factors, which may include intervention strategy factors, and direct outcomes. The limited usefulness of factors approaches to explaining and controlling IS related change within single organizations is now recognised theoretically and empirically in the IS literature [5,6], and this work extends these conclusion to interorganizational change. In the kind of situational / interactional theory put forward here, the relationships between events in the environment and actions of individual units that may act as change agents, and their long term consequences is less easily predicted. On the one hand, the robustness of routinized situated activity tends to make industry practices resistant to perturbations. Thus the theory presented here gives hope of understanding the nature of the frequently discussed phenomenon of resistance to change and the possibility of more principled approaches to overcoming it. On the other hand the complex web of interactions including positive feedback loops implied by the theory can make outcomes sensitive to small changes: small changes in the remote environments or small deliberate change actions might produce large and largely unpredictable changes to practices.

Secondly, the theory suggest that deliberative coordinated action by an industry as a whole, or units purporting to represent such a group position, may be severely limited in effectiveness, and this is certainly consistent with observation. The situation is even worse than that of change within a single organization because, while a powerful person such as the CEO of an organization might legitimately claim access to the kind of transcendental "aerial view" of action posited by planning approaches to change and be able to mobilise action of the basis of it, it is unlikely that any organization in an industry, including trade organizations, is sufficiently external to the power interests and cultural relations of the industry to make such a claim to an objective outside view. This is why the availability of such an industry wide representation is not part of the principle of reproduction of practices posited by this theory. On the other hand, as pointed out earlier, understanding the nature and robustness of situated routinized activity provides a theoretical basis for understanding controlled, incremental, bottom-up change and the changed role that deliberative planning might play in it.

search

B. Implications for understanding of adoption of interorganizational systems at an industry level.

The theory has potential application in analysing the adoption or non-adoption of inter-organizational systems, such as supply chain electronic commerce and Just-In-Time replenishment, in whole industries. For instance, some industries have taken to the use of EDI more readily and achieved greater levels of EC-compliance than others. Why is this so? The theory suggest several possibilities. One is the importance of changes in the remote environment in destabilising existing industry structures and routines and creating the opportunity for new ones or the amplifying the effectiveness of deliberative intervention. The Button Plan to radically improve the efficiency of the Australian automotive industry led to profound changes in relations among players in that industry, including improved cooperation between assemblers and parts suppliers, creation and strengthening of trade bodies and normative links including a unique uniform industry-wide approach to EC, creation of a niche for a government VAN, and near 100% EDI compliance of all trading partners [11,28]. Similarly, the appearance of the Internet as a new communication technology with new forms-based communication protocols has assisted large players in the retail industry to achieve 100% compliance and consequent supply chain wide distribution reforms. One of us [2] has argued that this was not simply due to direct characteristics of the new technology, but rather to a profound reshaping of the relations between a number of parties involved, including traders, infrastructure providers and regulatory bodies, allowing a new vision to emerge of mixed traditional and radical types of EDI in a more comprehensive network of communicative relations between sophisticated and unsophisticated trading partners, and a new distribution of costs and benefits among them. By contrast, the routine situated activities of units in some industries, such as the Australian Meat Industry [3,4], may be such as to effectively reject the possibility of improvement through EC-coordinated activity.

The essence of electronic EC-enabled interorganizational systems is that great efficiencies in the handling of materials can be achieved with low technology provided that the activities of participating organizations are coordinated through frequent, computer-to-computer communication. Achieving these high levels of coordination often requires some organization to incur extra costs, for instance by being prepared to handle smaller replenishment orders or becoming EDI-capable, or to assume greater risk by being prepared to operate with smaller buffer stocks. At the same time it is not clear that all parties will share equally the efficiencies achieved. Therefore, adoption of interorganizational systems usually involves renegotiation of trading arrangements to equalise the distribution of costs, benefits and risks between trading partners [29]. The present theory begins to explain why this is such a barrier to their adoption: the normal on-going activity of the industry does not make use of explicit representation of the overall industry practices upon which such negotiation might be based, so such representations or models have to be build in *ad hoc* episodes of concerted deliberation which are foreign to the normal *modus operandi* of the industry units. The severity of this barrier to industry wide reform is seen much more clearly from a situated action perspective than from naive positions that implicitly assume a representation theory of activity and conflate reasoning about action with action itself.

C. Methodological implications for research

The theory suggest that the appropriate way of studying the adoption of interorganizational changes within industries is to trace, by empirical research, the relations of various types that exist between the various types of individual units, the way in which these relations are constructed and maintained through the situated actions of the units, and the ways in which these structures together with remote environmental factors enable and constrain individual firm action and thus industry wide initiatives. Preliminary attempts to do this for diverse industries can be found in [2] and [3]. The theory presented here can thus act as a framework for principled analysis of case studies of interorganizational systems adoption. It can additionally provide a source of research agendas in much the same way as proposed by Orlakowski [6] for structuration theories of IS-enabled organizational change.

V. Conclusion

A number of important new ideas have been introduced in this paper. The first is simply the notion of using a whole industry as a unit of analysis in discussing EC adoption. While the diffusion of EC has been discussed previously, often the focus is on adoption by individual firms with the assumption that adoption by a critical mass of firms leads to industry wide adoption. The new focus on the industry as an actor raises the possibility of discussing industry characteristics that are favourable to EC adoption, or cross-industry comparisons of EC adoption. The second is the provision of a framework for discussing the concerted action or agency of the industry group, with a specific proposal about how such concerted action can be related to the individual situated actions of the group members. Finally, the paper applies a structuration-like theoretical framework to a larger unit, the industry group, than has previously been done.

The theory presented here came out of discussions about the different levels of uptake of EC technologies in different industries [4] and also from an analysis of the way the Internet has destabilised the traditional vision of EDI [2]. Many of the ideas are tentative and we need to analyse in detail the interactions and causal influences on firms that

search

exist in one or more industry sectors and verify that our theoretical constructs, particularly the division between immediate and remote environment, are adequate to explain the phenomena. This work is under way.

References

[1] D. Silverman, The Theory of Organisation. London: Heinemann, 1970.

[2] R. B. Johnston and H. C. Mak, "An Emerging Vision of Internet-Enabled Supply Chain Electronic Commerce," International Journal of Electronic Commerce, (Forthcoming), 2000.

[3] S. Gregor and R. B. Johnston, "Developing an Understanding of Interorganizational Systems: Arguments for Multi-Level Analysis and Structuration Theory," 8th European Conference on Information Systems, Vienna, Austria, 2000.

[4] S. Gregor and D. Menzies, "Electronic Data Transfer and Supply Chain Management: A Case Study of the Beef Industry," The 3rd Annual Collecter Electronic Commerce Conference, Aukland, New Zealand, 1999.

[5] M. L. Markus and D. Robey, "Information Technology and Organizational Change: Causal Structure in Theory and Research," Management Science, Vol. 34, No. 5, pp. 583-598, 1988.

[6] W. J. Orlikowski and D. Robey, "Information Technology and the Structuring of Organisation," Information Systems Research, Vol. 2, No. 2, pp. 143-169, 1991.

[7] G. Walsham, "Management Science and Organisational Change: A Framework for Analysis," OMEGA International Journal of Management Science, Vol. 20, No. 1, pp. 1-9, 1992.

[8] G. Shanks, "The Challenges of Strategic Planning in Practice: An Interpretive Case Study," Journal of Strategic Information Systems, Vol. 6, pp. 69-90, 1997.

[9] M. E. Porter, "Clusters and the New Economics of Competition," Harvard Business Review, Vol. 76, No. 6, pp. 77-90, 1998.

[10] H. C. Mak and R. B. Johnston, "Leveraging Traditional EDI Investment Using the Internet: A Case Study," The 32nd. Hawaii International Conference on Systems Sciences, p182, Maui, Hawaii, 1999.

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

[12] H. C. Mak and R. B. Johnston, "Tools for Implementing EDI over the Internet," EDI Forum: The Journal of Electronic Commerce, Vol. 11, No. 1, pp. 44-56, 1998.

[13] M. Callon, "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieu Bay," in Power, Action and Belief: A New Sociology of Knowledge?, Sociological Review Monograph 32, J. Law, Ed. London: Routledge and Kegan Paul, 1986, pp. 196-233.

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

[15] P. Dawson, Organizational Change: A Processual Approach. London: Paul Chapman Publishing Ltd., 1994.

[16] P. E. Agre and D. Chapman, "Pengi: An Implementation of a Theory of Activity," AAAI-87. The Sixth National Conference on Artificial Intelligence, pp. 268-272, Menlo Park, CA., 1987.

[17] P. E. Agre, Computation and Human Experience. New York: Cambridge University Press, 1997.

[18] B. Nardi, "Context and Consciousness: Activity Theory and Human-Computer Interaction," Cambridge, MA: MIT Press, 1996.

[19] L. A. Suchman, Plans and Situated Actions. Cambridge: Cambridge University Press, 1987.

[20] W. J. Clancey, Situated Cognition: On Human Knowledge and Computer Representations. Cambridge: Cambridge University Press, 1997.

[21] R. A. Brooks, "A Robust Layered Control System For A Mobile Robot," IEEE Journal of Robotics and Automation, Vol. 2, No. 1, pp. 14-23, 1986.

[22] H. Hendriks-Jansen, Catching Ourselves in the Act: Situated Activity, Interactive Emergence, Evolution, and Human Thought. Cambridge, MA: The MIT Press, 1996.

[23] R. B. Johnston and M. Brennan, "Planning or Organising: The Significance of Theories of Activity for the Management of Operations," OMEGA, International Journal of Management Science, Vol. 24, No. 4, pp. 367-384, 1996.

[24] R. B. Johnston (1999). The Problem with Planning: The Significance of Theories of Activity for Operations Management, Unpublished PhD Thesis. Monash University, Clayton

[25] P. E. Agre and I. Horswill, "Lifeworld Analysis," Journal of Artificial Intelligence Research, Vol. 6, pp. 111-145, 1997.

[26] P. E. Agre, "The Dynamic Structure of Every Day Life," MIT Artificial Intelligence Laboratory, Cambridge, MA., Technical Report 1085, 1988.

[27] P. Hart and C. Sanders, "Power and Trust: Critical Factors in the Adoptions and Use of Electronic Data Interchange," Organization Science, Vol. 8, No. 1, pp. 23-42, 1997.

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

[29] S. Kurnia and R. Johnston, "The Issue of Mutuality in ECR Adoption: A Case Study," 8th European Conference on Information Systems, Vienna, 2000.