

Theoretical Impediments to Understanding B2B Electronic Commerce

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Abstract

This paper proposes that the lack of a theoretical framework able to address policy issues on the firm as well as the industry level in an integrated manner contributes to a failure of developing effective e-commerce policies. Specifically, theoretical approaches fall into the two broad categories of market and organization theory with a gaping chasm in between. We elaborate on our proposition by outlining three areas of e-commerce policy formulation plagued by this conceptual problem and illustrate our argument by three case examples. We then discuss the potential of four selected theories to overcome the conceptual chasm between organization and market theories, namely industrial organization theory, evolutionary approaches, coordination theory, and industry life cycle theories.

Keywords: EC strategy formulation, e-business in developing countries, government initiatives & funding

Introduction

So far, electronic commerce has been successfully used to transform companies and whole supply chains (viz. the examples of Dell and Cisco) but also lead to many high-flying expectations being disappointed, for example in the areas of electronic data interchange, electronic retailing, and B2B marketplaces. Apart from phenomena of hype and fashion, which might partly explain these disappointing experiences, it seems to us that there is a conceptual or theoretical barrier to devising effective policies in the realm of electronic commerce which provides another, deeper explanation. This stems from the traditional division of labor between the academic disciplines of organization science and market theory (economics). While organization science focuses on internal phenomena of ‘organizations’ (firms, ministries, public agencies, schools, etc.) treating the environment as an undifferentiated pool of resources and constraints, market theory focuses on the interaction between organizations while treating their internal phenomena as an undifferentiated set of functions relating inputs to outputs (firms as production functions). This state of affairs has often been complained but, as of yet, not been resolved.

Whereas the conceptual deficiencies resulting from this chasm might be accepted when dealing with mainly internal operational matters in organization science or matters of macro policy in economics and some competition issues on the firm or industry level in abstract terms, they pose an insurmountable obstacle for comprehension and decision making when it comes to electronic commerce which, almost by definition, links internal operations to external resources and constraints. The above mentioned examples of Dell’s and Cisco’s supply chain organization are used abundantly in the more practical literatures but cannot be analyzed from either an organization science or economics point of view (we will briefly review these cases below). Other examples are industry-wide organizations facilitating the establishment of electronic commerce such as RosettaNet (briefly described below) or collaborative efforts to set up B2B electronic marketplaces. From an

organization science point of view, these phenomena can hardly be treated as part of the organizational environment as they are created by the organizations themselves. From an economics point of view, these phenomena create a puzzle which might be framed in the mirror expressions of “the firm as a market” and “the market as a firm”. For example, when considered a firm, an industry-wide integrated marketplace would seem like a monopoly; when considered a market, it would seem to approach the ideal of a ‘perfect market’.

Some efforts have been made in reconciling these views and analytical perspectives. Specifically, new institutional economics (including transaction cost and agency theory) and neo-institutionalism (in sociology) need to be mentioned here. However, new institutional economics tends to focus on bilateral transaction relationships (i.e. the ‘make or buy’ decision) thus excluding phenomena of collective decision making in an industry as a whole while neo-institutionalism is based on the notion of a uni-directional impact of a firm’s institutional environment on its internal structures thus leading to an analogous failure to explain phenomena on the industry level.

This paper will first analyze the implications of the conceptual chasm outlined above for a number of issues related to electronic commerce, including supply chain integration, development policies, and EC strategy formulation. It will illustrate this analysis by the above mentioned cases in the field of B2B electronic commerce (Dell, Cisco, RosettaNet). We will then try to outline and evaluate possible ways of overcoming this conceptual chasm. Specifically, we will evaluate the potential of existing theories for conceptually bridging this gap including industrial organization theory, evolutionary economics, coordination theory, and industry life cycle theories.

Unresolved theoretical issues in B2B e-commerce

Supply chain integration

It has been demonstrated that oscillations in demand signals tend to increase as signals travel upstream across the supply chain (cf. [16]). Lee et al. identify several reasons for this effect (called ‘bullwhip effect’) which are mainly related to the fact that each supply chain member will add a safety margin to the signal they receive from the downstream organization.

Lee et al. suggest that this effect can be reduced by avoiding multiple demand forecast updates, breaking down order batch sizes, reducing price discounts, and eliminating gaming in shortage situations (id.), i.e. by coordinated action among supply chain members. In effect, this requires some degree of centralized decision making across a whole supply chain. This situation cannot be addressed from either a market nor an organization theory point of view. Market theory (i.e. neo-classical economics) assumes that firms make decisions based on market signals from their immediate downstream customers. This, however, is exactly the type of behavior which leads to the bullwhip effect in the first place. Similarly, organization theory assumes that companies act in an environment characterized by dependence on other organizations. Organizations act to minimize this dependence on other organizations rather than to increase it. Therefore, coordinated action among supply chain members would be difficult to explain either.

One way of implementing coordinated supply chain planning clearly would be via an inter-organizational information system as has been pioneered in the airline industry ([6]). Current approaches, however, mirror the conceptual chasm between market and organization theory as supply chain management is either considered an add-on to internal ERP systems facilitating the exchange of information between adjacent supply chain members, or a stand-alone electronic marketplace facilitating the offloading of excess inventory between two production stages in the supply chain. Conceptual approaches towards integrated supply chain management systems are extremely rare (cf., for example, [21] and [20]).

EC strategy formulation

Companies who view electronic commerce as a strategic opportunity typically adopt a two-stages approach based on the '80:20 rule' popular as a heuristic in many fields of operations management. According to this rule, 20% of customers/suppliers account for 80% of the total transaction volume (in terms of data exchanged rather than the value of transactions). Thus, the first stage consists of connecting those suppliers/customers that account for the bulk of total transaction volume leaving the remaining 80% to be connected in the second phase. However, the result typically is that companies never reach the second stage (cf., for example, [5]).

In contrast to the first issue discussed above (vertical coordination across a whole supply chain), the main problem involved in the phenomenon described here is a lack of horizontal coordination across production stages. Connecting information systems across company borders involves substantial changes on the technical as well as on the organizational level; only then can the benefits of automatic data processing across company borders be reaped (cf. [15], [35], and [30]). Thus, an electronic commerce strategy following the 80:20 rule will take into account the requirements of the group of most important customers/suppliers (in terms of transaction volumes) while neglecting those of the remaining partners (representing the majority of customers/partners). Not surprisingly, these then refuse to participate in the system designed without their participation and input because they will not benefit from participation or feel that they benefit only disproportionately.

Again, potential solutions to this problem could not be addressed by traditional market and organization theories. Market theories are hostile to any form of horizontal coordination as they routinely assume that these represent forms of disguised collusion while organization theory views horizontal relationships as characterized by hostile competition for scarce resources allowing for few opportunities at collaboration. The term 'coopetition' has been coined to describe a phenomenon which also comprises the situation described above and which evades the analytical reach of both, market and organization theory.

EC development policy

Electronic commerce is often seen as an opportunity to promote economic development and international trade. In fact, the first wave of developing electronic commerce in the business realm (so-called Electronic Data Interchange, EDI) was dominated by an international effort to develop document standards suitable for electronic exchange and automated processing sponsored by the United Nations Working Party 4 (responsible for trade harmonization) on the assumption that EDI will promote trade (these standards are known as EDIFACT, Electronic Data Interchange for Administration, Commerce, and Transport; cf. [10]).

On a regional level, the Economic Commission of the European Union established a program to promote adoption of electronic commerce in the business realm specifically targeted at small and medium sized companies (called TEDIS, cf. [13]). In order to prevent the establishment of a multitude of point-to-point links (bilateral EDI), the requirement for obtaining funds often was that projects comprise at least three partners. However, small and medium sized companies typically do not have the resources nor the expertise to work through the elaborate application process required for obtaining these external funds. Thus, the commission depended upon industry associations to help them allocate the funds to applications of EDI among small and medium sized companies. This worked well in some cases but not in all. Specifically, industry associations often used EDI as an opportunity to buttress their legitimacy by emphasizing the interests of their members. As industry associations are typically organized around the type of input or output material (e.g. the 'food processing industry' or the 'textile industry'), they represent organizations on one production stage rather than whole supply chains. For this reason, industry associations often tried to promote solutions supposedly most appropriate for their own members (among these, specific interpretations of the EDIFACT standards) which then collided with those of upstream or downstream groups (which were also represented by associations; cf. [24]).

From this example it can be seen that the institutional structure of an industry as characterized by industry associations etc. matters when implementing EC development policies. However, the institutional structure of an industry is a phenomenon which, again, is not captured by traditional market and organization theories. Market theories assume that a market consists only of competing firms representing the two sides of a market while organization theories view a firm's environment as created externally rather than by collective action of the firms themselves.

Illustrative cases

Companies as markets: Dell and Cisco

Dell Computer and Cisco Systems are two companies that have successfully harnessed the economic potential of the Internet and e-commerce.

Dell's business success was built on a direct distribution model (the 'direct model') bypassing wholesale and retail stages. To achieve this, the company had to develop a sophisticated method of supply chain management to ensure that customers could be served without holding a huge inventory since the speed of technological change quickly erodes the value of any finished goods inventory in the personal computer industry (cf. [27]).

Information technology plays an important role in enabling the 'direct model'. On the one hand, customer orders, now mostly placed on Dell's website, are automatically routed to the appropriate assembly plant. On the other hand, Dell has reduced its parts inventories from 32 days in 1995 to 7 in 1998 based on just-in-time links with a drastically reduced set of suppliers and logistics services providers (id.). For example, Sony monitors will be picked up by the shipper from Sony warehouses and the other components of a customer's PC order from Dell's warehouse and then delivered to the customer. This coordination is based on a sophisticated external data exchange infrastructure.

Cisco Systems, Inc. is another role model of leveraging the Internet to build a new type of company in the network age (cf. [25]). Founded in 1984 and brought public in 1990, Cisco now dominates the "Internetworking" market.

The ultimate reason for the success of Cisco probably lies in its philosophy towards IT organization structure. It is fair to say that Cisco is a firm built on two networks: its own global intranet and the universal Internet. On the one hand, Cisco built its business processes on its own global intranet, and Cisco people deployed around the world interact on this intranet to address business issues and customer needs. On the other hand, a very high percentage of Cisco customers', partners', and suppliers' interaction with the company is network-based and begins at Cisco's homepage.

From the standpoint of economics, there are several difficulties in understanding these two firms. First, even the definition of a traditional firm does not apply here. There is no way in which Dell and Cisco fit into the black box view of traditional firms. Second, the boundary between markets and firms is getting blurred. Both Dell and Cisco are outsourcing significant parts of their internal functions to other firms specializing on those activities. While industrial organization theorists tackle the issue of vertical integration, the boundary between firms has to be clearly delineated in the first place. Third, it is not so clear-cut who the firm's competitors and partners are. In the Cisco case, Cisco is working with Microsoft to create an industry standard for security over the Internet, working with MCI to deliver premium Internet services, and working with HP to develop and sell Internet-based corporate computing systems built with each other's products. This kind of networked relationship is hard to find in traditional industries and there is not an appropriate economic theory to give a coherent and rational explanation.

Markets as companies: RosettaNet

RosettaNet is a consortium of the IT, electronic components, and semiconductor industries created in 1998 aimed at facilitating business-to-business e-commerce (or EDI, as it used to be called before the emergence of the Internet in the public mind). In contrast to earlier EDI initiatives, this consortium provides standards on the syntactic, semantic, and pragmatic level of computer-to-computer communications. Syntactic standards specify the structure of a message so that a computer 'knows' which part contains which type of information (product description, customer address, etc.); semantic standards specify codes for specific types of information so that a computer can 'understand' the contents of a message (such as product numbers or country codes); finally, the type of action expected when sending an electronic message is specified on the pragmatic level (such as

“confirm receipt of message within four hours”).¹ Integrated data processing across company borders requires complete specifications on all three levels (cf. [15]). In the past, EDI initiatives have mostly been limited to standardizing specifications for the syntactic and semantic levels.

Thus, any company which commits to RosettaNet standards will not only have to comply with certain syntactic and semantic standards, but also with pragmatic standards. For example, it must commit to acknowledging or refusing an order within 24 hours after receiving a purchase order. This illustrates that the main benefit of conducting business electronically does not stem from the increased speed of sending business documents (which could be achieved by fax or telephone as well), but by compressing the time it takes to *act* upon the received information.

There are two scenarios for further development. (1) RosettaNet limits itself to facilitating the process of reaching agreements on the pragmatic level by providing contract templates. This is the approach adopted by earlier initiatives and thus does not represent a significant advantage over traditional EDI initiatives. (2) RosettaNet acquires the ability to legally bind members to generalized agreements including the ability to sanction non-compliance with these agreements. In this case, any of RosettaNet’s member firms could conduct business electronically with any other member without prior negotiation and agreement. Thus, RosettaNet would become a new legal entity able to coordinate member firms’ behavior (just as companies are legal units able to coordinate their employees’ behavior).

It is clear that such a scenario would pose extraordinary difficulties for traditional market and organization theories. In contrast to the examples of Cisco and Dell, the difficulties do not consist of blurring boundaries between firms but the emergence of a whole new entity which is captured by neither market nor organization theory and which represents a form of centralized industry/market-wide decision making based on voluntary devolution of decision autonomy. Market theory could only address this phenomenon as a cartel while organization theory would find it difficult to explain that organizations give up (part of) their autonomy.

Possible theoretical approaches

Industrial Organization

Traditional microeconomic theory advocates the virtue of free market, as shown in the first and second social welfare theorem. The market mechanism has the power of achieving productive and allocative efficiency. Furthermore, virtually any desirable social outcome in the ‘Pareto Optimal’ solution set is obtainable through reallocation of endowments of economic agents. Unfortunately, all of these nice outcomes can only become reality under the unrealistic assumptions of perfect information, perfect competition, no externality, unambiguous property rights, etc. Although the theories are useful in teaching people the tenet of free market competition, the problem is that it is “too perfect to be true”.

Under this framework of economic analysis, the firm is treated as a black box of converting inputs into outputs. This might be a close approximation of Adam Smith’s era type of firms when the mechanisms of free markets were just beginning to take shape and no firm was big enough to have market power. With the emergence of large corporations in modern times and the market environment becoming more complicated, the oversimplified model of perfectly competitive markets and the mathematical device view of firms contradict sharply common observation and experiences.

Theoretical developments in industrial organization in the last two decades have changed the landscape of analysis of real world business phenomena dramatically. On the one hand, the advent of game theory provides a powerful framework of explaining the environment where firms live and interact with each other. On the other hand, by emphasizing the lack of perfect knowledge, the existence of costs in the acquisition and communication of information, the bounds on individual rationality, the new theory of the firm enhances our understanding of problems and forces operating in business decisions. These developments seem to be a

¹ See “RosettaNet Implementation Framework Specification”, Version 1.1, 8 November 1999, and RosettaNet’s “User’s Guide - Understanding a PIP Blueprint”, Release 1.3, 4 January 2000.

promising starting point for inquiring the forces that contribute to the existence and diversity of firms, the influences bearing on internal organizational structures and their impact on behavior, the formation of business strategy, and the relationship of firms with their customers and suppliers.

As discussed above, a new framework needs to be established to understand the new phenomena in electronic commerce. The ideal concept will be one that breaks up the traditional divergence between markets and internal organization of firms. The significance of market characteristics for the behavior and efficiency of firms has occupied industrial organization economists for half a century or more. The well-known Structure – Conduct - Performance paradigm (SCPP) has been the dominant tool of analyzing the business environment. Michael Porter's five-forces analysis framework clearly is a reinterpretation of the SCPP approach which has been the most successful and most widely adopted tool for performing industry analysis. One major weakness of this framework is that it does not address the complexity of firms' diverse internal structure. The five forces are still five black boxes. Another, related problem is the implied assumption 'strategy follows structure' which neglects the role of decision making on the firm level in shaping the development of an industry.

Evolutionary approaches

Evolutionary approaches towards understanding organizations and markets are based on the assumption that the three processes of variation, selection, and retention described by Darwin and applied to the evolution of natural species can also be applied to social phenomena. Under this assumption, social entities are (intentionally or randomly) varied, selected, and, if successful, retained ([2]).² Thus, the explanations provided by evolutionary approaches crucially depend upon (1) the choice of a selection mechanism and (2) the subject of selection. There is a general tendency in evolutionary thinking that selection operates on the criterion of resource efficiency thus making these approaches akin to traditional neoclassical market theories. However, other selection criteria are considered as well such as legitimacy or political forces. Even the possibility of evolving selection criteria has been considered implying a meta-selection process ([2], p. 27).

All of the following have been suggested as possible subjects for selection: (a) (organizational) routines, techniques, and technologies; (b) 'bounded units' such as firms and agencies ('organizations'); (c) organizational forms; (d) whole populations; (e) communities consisting of several populations; and (f) selection criteria ([2], p. 35-9). However, there is a significant degree of ambivalence in the language adopted by evolutionary theorists. For example, typically there is no explicit distinction being made between (b) and (c) implying that, generally, the subject of selection is the organizational form rather than a specific company on the organizational level of analysis. Also, communities are defined as groups of organizations that are similar with respect to selective forces in which case the subject of selection would, again, be the organizational form. Finally, if an organizational form is defined as a bundle of organizational practices, the difference between (c), (d), and (a) also disappears. Regarding possibility (e) (selection of communities of populations), there is considerable resistance to allowing for this possibility even among evolutionary theorists ([2], p. 38) not to speak of critics of evolutionary approaches (cf., for example, [9], and [26]). Regarding the possibility of selection criteria themselves being the subjects of selection, the conceptual problems are only relegated to the meta-level.

The process of retention is introduced to avoid the possibility of random variation blindly eliminating successful variations. However, there is no clear answer to the question of how this retention process works other than by reflexive, knowledgeable and interested agents recognizing positive effects of a certain variation (which might not have been foreseen) and retaining the variation via communication and documentation. Assuming the existence of such a process, successful variations will cumulate over time leading to a stock of such variations in an organization or a population.

The flexibility of evolutionary approaches allows for explaining social phenomena on different levels of analysis. Therefore, this approach seems to be promising with regard to the question addressed here, namely the analysis of organizational phenomena on the firm and the industry level from one analytical point of view. For example, a supply chain could be specified as a population of mutually dependent organizations; then, industry structures could be analyzed by treating the individual supply chain as the subject of selection. Similarly, the individual firm could be specified as the subject of selection within a population of similar firms. Thus, the same analytical framework would be applied for analyzing social phenomena on the firm and the industry level.

² For a critical view of evolutionary approaches cf. [4], and [7]. For a general review, cf. [11]; for critical but sympathetic efforts at extension cf. [34] and [28].

However, in our view, this flexibility of the framework is due to its being under-specified rather than generic. Above, we have already mentioned and discussed some of the ambiguities which plague evolutionary approaches. In a way, the evolutionary framework can be considered a meta-theory which, with suitable specifications, can be transformed into any known social theory, even a theory of historically pre-determined development paths so despised by evolutionary thinkers, simply by invoking appropriately defined selection and retention force. Evolutionary theorists criticize the tendency of ascribing intentions to actors derived from observed outcomes. With the same right it might be argued that selection criteria are only visible with hindsight. Only once a theory 'commits' to a specific variation mechanism, selection criterion, and retention mechanism can it be used to predict social phenomena and thus become a guidepost for policy making.³ Evolutionary theory, however, has immunized itself against this type of critique as one of its fundamental axioms is that outcomes of social behavior cannot be predicted ([2], p. 33-5).

Coordination theory

Recently, efforts have been made to unify a body of knowledge under the name 'coordination theory' drawing together insights from computer science, economics, and organization theory ([18]). The idea is to describe types of coordination requirements and match these with possible coordination solutions. In an effort to classify these processes, Thompson's ([31]) distinction of three types of interdependencies is used, albeit in a modified form ([19]). Coordination is then defined as "managing [inter]dependencies between activities" ([18], p. 90).

Thompson has suggested that the three types of interdependencies are linked to three forms of coordination, namely the use of rules, plans and teams ([31], p. 60). However, organization theory has developed a richer set of coordination mechanisms which should be considered for classification purposes. Mintzberg ([23]) proposes to distinguish between five coordination mechanisms: mutual adjustment, direct supervision, and standardization of work output, work process and skills (a similar list has been proposed by [12]; for a review of the relevant literature cf. [8]). In addition to these lists of coordination mechanisms, the price mechanism needs to be included since it clearly represents a form of coordinating economic activities.

The advantage of this approach regarding the problem considered here is that it leaves open the question whether activities are coordinated within or between firms. It sets out with a certain coordination problem (i.e. with some interdependent activities) and proceeds by trying to identify the most suitable coordination mechanism.

However, this approach also contributes to a major weakness: the neglect of motivational issues. Social organization involves a solution to both the coordination and the motivation problem (cf. [22]). Malone and Crowstone ([18]) acknowledge this omission but claim that their approach will still contribute insights into the problem of coordination in social organization (p. 91). Although this might be the case, the theory will not be sufficient to explain social phenomena unless it also addresses the problem of motivation.

Industry life cycle theories

The concept of the industry life cycle has been originally introduced by Utterback and Abernathy (cf. [32] and [1]) based on the notion of 'dominant designs'. According to this hypothesis, a dominant design emerges in the course of industry evolution and marks a fundamental shift in the way firms compete and cooperate. Before a dominant design emerges, product design is 'fluid' meaning that designs are frequently changed and many alternative designs exist. Competition is therefore mostly based on product innovation and design modifications aimed at closely meeting specific customers' needs. Accordingly, anyone who has a new design concept can easily enter the industry so that the number of firms during this period is usually high. However, once different designs are consolidated into one (dominant) design, competition policy shifts away from product to process innovation as companies seek to lower costs. As this usually involves a substitution of machines for labor, economies of scale emerge which, on the one hand, erect a barrier to entry for new prospective competitors and, on the other hand, lead to a consolidation among firms via exits and mergers. Thus, the number of firms tends to decline after a dominant design has emerged. The emergence of a dominant design is therein seen as a "result of

³ This is the strength of population ecology which is based on rather narrow specifications (and criticized for that).

a fortunate combination of technological, economic, and organizational factors ([29], p. 416-7). The pattern of increasing and decreasing total number of firms before and after the emergence of a dominant design represents one of the best established empirical pieces of knowledge in business analysis (cf. [33] and [14]).

The concept has been extended by Anderson and Tushman ([3]) who provide the 'limiting marks' around a life cycle by studying technological discontinuities leading to the concept of a technology life cycle. A technology life cycle thus begins with a technological discontinuity, i.e. a technological innovation, goes through an 'era of ferment' concluded by the emergence of a dominant design, enters an 'era of incremental change' and is concluded by another technological breakthrough which thus sets off a new instance of the technology life cycle. They tested their model on three industries (including the minicomputer industry) and found general support for it albeit the number of observations was too small to test the results statistically. They also noted that not all technological innovations lead to the emergence of dominant designs (four out of the 16 studied).

This extension of the model seems useful and necessary in order to 'close the loop' of the otherwise linear (rather than cyclical) industry life cycle but also in order to move away from a purely product-based view of industries. Therefore, the notion of a technology life cycle seems to be more appropriate than that of an industry life cycle as industries might move through successive technology life cycles.⁴

Industry life cycle theories promise to solve the problem addressed in this paper because they link firm-level strategies to the evolution of the whole industry. The theory does not imply that industries necessarily move through the whole cycle. Rather, it depends upon the actions of firms as well as external events whether they will move from one stage to the next (as indicated by the possibility of dominant designs failing to emerge) or when a new cycle begins. However, it does predict a pattern of evolving constraints on the actions of firms which represent the consequences of actions of all other firms in an industry. By this way, they integrate firm and industry level analysis.

Comparison of the four approaches

In summary, all four theories discussed above have strengths and weaknesses. The strength of industrial organization theory (as the relevant branch of neo-classical thinking with respect to the problem discussed here) is that it has opened itself to phenomena of real world economics. However, its main paradigm (Structure-Conduct-Performance), although linking industry and firm level analysis, cannot deal with firm behavior aimed at influencing its environmental structure which would be crucial for explaining phenomena of B2B e-commerce.

The strength of evolutionary approaches lies in their flexibility which enables the researcher to apply this approach to both, the firm and the industry level of analysis. However, a choice regarding the selection mechanism and the subject of selection must be made before this theory becomes operational. We argued that this choice constitutes a crucial commitment of a theory regarding its predictive power. Evolutionary approaches tend to avoid this commitment implying that they are under-specified. Specifically, the explanation of e-commerce phenomena would require that the subject of selection and the selection mechanism be specified which could lead to significant difficulties as evolutionary developments might take place on both levels simultaneously.

The strength of coordination theory is that the question of organizational boundaries is treated as a variable contingent upon coordination requirements. Thus, a specific configuration of organizational devices (such as employment contracts and just-in-time arrangements) can be treated on the same level of analysis rather than two distinct (and irreconcilable) ones (firm and market). Its weakness, however, is that it neglects motivational issues and therefore cannot explain organizational phenomena without support of another theory. As the problems of coordination and motivation are intrinsically linked, it is difficult to see how such a combination of theories could be achieved without a meta-theory.

Finally, the strength of industry life cycle theories (augmented as technology life cycle theories) is that they build upon a well established empirical phenomenon and link industry and firm level of analysis as a relationship of critical actions and an evolving pattern of external constraints. Without intentional and risky

⁴ This extension also addresses most of the critique by Malerba and Orsenigo ([17]) regarding the industry life cycle concept.

action on the firm level, firms will not be able to move from one phase to the next. However, their actions are constrained in a way which depends upon the specific phase characteristic of an industry in a given point of time and are thus predictable. The weakness of life cycle approaches is that phase transitions are currently not sufficiently understood and must be treated as external events.

Conclusions

We conclude that industry life cycle theories represent the most promising approach towards integrating firm and industry level analysis and thus the most promising basis for understanding electronic commerce in the business realm. However, industry life cycle theories are mostly based on an empirical regularity and the question arises if this regularity will persist under the conditions indicated by our case illustrations or if completely new patterns will emerge. It might be argued that the phenomena described in our case illustrations are themselves driven by the industry life cycle as all three cases regard the IT industry which might have entered the second life cycle stage based on process innovation rather than product innovation. Implementation of B2B e-commerce clearly represents an instance of process innovation. It seems necessary to explore the role of the institutional structure of an industry over the industry life cycle in more detail before this question can be answered. If it turns out that elaborate institutional structures on the industry level are characteristic for the second stage of an industry life cycle, the emergence of phenomena illustrated by our case examples would fit the overall pattern and industry life cycle theories would seem to be applicable to the analysis of electronic commerce. Otherwise, the industry life cycle theory might prove less helpful in understanding electronic commerce.

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