

Tryk: Handelshøjskolens Reproduktionsafdeling
Oplag: 60
ISBN: 87-7869-030-7
ISSN: 1398-7461
Publikation: 1998-11
Oktober 1998

Mutual Adaptation and Technological Innovation

Henrik Sornn-Friese

Department of Industrial Economics and Strategy

Copenhagen Business School

Nansensgade 19, 6

DK-1366 Copenhagen K

Phone: +45 38 29 32

Fax: +45 38 15 25 40

hsf.ivs@cbs.dk

2nd DRAFT

October 1998

Abstract

In evolutionary economics the firm is the sole locus of economic and technological change, and only little is said about the analytical importance of economic relationships. An emerging theme in the fields of economic sociology, however, is the idea that economic activities are embedded in social context. This paper unpacks the notion of embeddedness as a relational concept linking micro-behavior and macro-outcome and relates this to the ongoing discussions on technological innovation and the evolutionary dynamics of firms and industries. It discusses how firms to different degrees are embedded in economic relationships, and how this influences innovative activity (or economic activities more generally) through processes of mutual adaptation. Empirical examples of differently embedded firms in the Danish road haulage sector is put forth, and it is argued that the degree and type of embeddedness matters for innovative activity.

Key words

Embeddedness; technological innovation; evolutionary economics; economic relationships; learning; knowledge; the Danish road haulage sector

Acknowledgements

Helpful comments from Mark Lorenzen, Department of Industrial Economics and Strategy, Copenhagen Business School on an earlier draft of this paper is gratefully acknowledged. The usual disclaimer applies.

Introduction

In evolutionary economics the firm is the sole locus of technological, economic, and institutional change. In this body of literature insights concerning the complex relationship between technological change, competition, firm specific competencies, and economic growth are offered and, thus, the unrealistic proposition that firms can adapt to changes easily is challenged. To the single business firm factors and tendencies of change represent both 'windows of opportunity' stressing the timing of technological experimentation and adaptation, and uncertainty and ambiguity constraining firm behavior and performance. It is, however, rarely questioned, not to mention integrated into the evolutionary economics framework, how interfirm collaborative arrangements affect competition and market allocation processes and thereby constitute industrial and organizational dynamics.

Lundvall (1988, 1993) has argued that in an economy characterized by a highly developed division of labor technological innovation largely takes place in intermediate institutional set-ups -- what he calls organized markets. The most fundamental aspect of the organized market is the ongoing processes of information exchange between users and producers of product innovations. The exchanged information involves a change in the knowledge base of both parties, a change characterized as an interactive learning process that enhances the innovative capability of the producer and the competence of the user (Lundvall 1993: 55). Lundvall's argument takes an embeddedness position and is largely an empirical one. In other words, it is recognized that economic activities such as technological innovation, strategic management, competence-building, and so forth are embedded in and affected by social relationships between economic agents (for example, business firms). The economic relationships within which innovation takes place involve common elements of technical knowledge; codes of communication; and social relations involving mutual trust and shared or institutionalized social values (Lundvall 1993: 60). Furthermore, learning within and between business firms are an inherent feature of technological innovation processes. Others have argued that such social embeddedness underlie the dynamics of organizational populations (Baum and Oliver 1992, Miner et al. 1990) and the structural dynamics within and between organizations (Fombrun 1986, Zucker and Kreft 1994). Recently it has been used to connect (or rather reconnect) business strategy to its social surround (Eisenhardt and Brown 1996, Gimeno and Woo 1996, Miller 1996, Murtha et al. 1996, Oliver 1996, Porac and Rosa 1996, and others).

A main point in this paper is that evolutionary theory would benefit from a relational conception of economic activities, that is, by acknowledging economic relationships as a distinct level of analysis important aspects of the organization of innovative activities could be incorporated in the evolutionary economics framework. This paper unpacks the notion of embeddedness as a relational concept and relates this to the ongoing discussions on technological innovation and the evolutionary dynamics of firms and industries. The basic assumption is that any business firm is embedded in communities or ecologies of business firms and other organizations that mutually adapt. The engaging questions are just how and to what degree the business firm is embedded in particular social context and how evolutionary processes create variations among business firms within communities -- variations, for example, in products and services; in processes and technologies; and in organization and management.

I argue for an evolutionary theory of economic relationships that links micro-incentives and behaviors with macro structures and processes. The point is that the embeddedness concept is a good outset for grasping evolutionary dynamics based on mechanisms of both adaptation and

selection. An evolutionary theory of economic relationships emphasizes and reflects innovation as the incremental and nested progression of various interrelated processes of variation, selection, adaptation, and retention managed and organized within and between interdependent business firms. In this respect, the dynamic aspects of interfirm information sharing; information stickiness; knowledge creation; and information and knowledge diffusion are key explanatory elements. The general argument is that both the individual firm and its social context are relevant levels of evolutionary analysis, but that the target of evolutionary theorizing is the linkage between these levels.

A useful starting point is the dynamics of ongoing economic relationships (Granovetter 1985, 1993), important factors of which are the nature and direction of influence. Do social contexts (for example, other firms, regulatory bodies, labor unions) largely induce the economic behavior of business firms as depicted in, for example, industrial economics or in the traditional population ecology (Hannan and Freeman 1977, 1989)? Are business firms autonomous and self-governing, capable of internal evolution, and the architects of their own business context as maintained in, for example, the resource-based theory of the firm?¹ Or, do business firms and their context mutually influence one another as suggested in important contributions to evolutionary economics (for example, Nelson 1998, Nelson and Winter 1982, Shapira 1994), in the behavioral theory of the firm (Cyert and March 1963), and in recent versions of population ecology (for example, Burgelman 1991, Burgelman and Mittman 1994, Haveman 1992, Meyer 1994, Miner 1994)?

The paper proceeds as follows. In section 1, the concept of embeddedness is introduced and elaborated on. It is argued that embeddedness is a relational concept that links the actions of economic actors to economic relationships and social structures. The section also considers the way the embeddedness concept has been used in studies of strategy and the organization of business firms. Typically, social context is treated as independent variable and most studies give a structural explanation to firm heterogeneity and do not explain institutional variation at all. It is argued that in order to account for different degrees and types of embedded economic behavior and institutional change it is necessary to develop a more complete and complex evolutionary explanation that links micro behavior and action to macro processes and outcomes. Section 2 provides an empirical example of embedded technological innovation in the Danish road haulage sector. It is shown that technological innovation in this particular setting is embedded in social structures internal and external from the firm -- social structures that differ from those of the traditional neoclassical market. Furthermore, it is shown that technological innovation depends on the type and degree of embeddedness. In the last section key elements of an evolutionary theory of economic relations are considered, although my argument is not yet as clear and developed as I would like it to be.

¹ This is very explicit in Grant (1991: 116) when he states that “when the external environment is in a state of flux, the firm’s own resources and capabilities may be a much more stable basis on which to define its identity.”

The Social Embeddedness of Economic Activities

Granovetter (1985, 1992, 1993) asserted that all economic action is embedded and enmeshed in relationships and social institutions that affect its functioning. This is an ontological statement in that it states that economic relationships and social structures might in fact be real and have causal liabilities of its own. It is also an epistemological one in drawing attention to the diversity of meaning, action, and subjectivity in economic relationships. Granovetter explicitly links economic action to the institutional arrangement of exchange and embeddedness is, thus, distinctly a relational concept. In this manner, embeddedness is a relational concept that requires researchers to focus attention on more complex and complete explanations that link micro to macro and account for the ways in which the various levels of explanation interpenetrates. It is one attempt to integrate traditional dichotomies such as, for example, action and structure; individualism and collectivism; the economic and the social; epistemology and ontology.

Collective phenomena like, for example, business firms are seen primarily as the expression of relatively enduring internal and external relationships. It is a view on the social as fundamentally consisting of and depending upon relations. This conception of economic and social action is not rejecting the being of individuals and collectives. Rather it emphasizes “the role that social relations play in determining the course of an individual’s life or the possibilities for collective action” (Bhaskar 1989: 7).

Linking Economic Action and Social Structure

One of the main cores of Granovetter’s embeddedness approach is not so much a rejection of ‘rational actor’ models and an interest in social institutions as independent variable (though this seems to be how embeddedness is mostly applied in empirical research) as it is, more profoundly, a rejection of both methodological individualism and collectivism.²

Granovetter asserts that a fruitful analysis of economic behavior must avoid the atomization of economic actors implicit in the so-called undersocialized and oversocialized theories of human action. Actors do not take action or make decisions as atoms outside a social context, but neither do they mechanically and automatically adhere to the social context (although some generalized morality must be granted). Actors’ attempts at purposive action are instead embedded in concrete, ongoing systems of social relations (Granovetter 1985: 487). The point is that social relations and social structures, cultures, practices, routines, etcetera in some sense exist prior to any individual act and partly guide it by providing limiting and focusing conditions. In this manner, the embeddedness concept implicitly contains cognitive elements. Instead of taking actors preferences for given the

² The problem with methodological individualism is about how to give a non-social explanation of individual behavior (for a thorough discussion of methodological individualism, see Hodgson (1989, pp. 53-72)). Even though methodological individualism provides a sharp analytical cutting edge, it also reduces everything to individual preferences and purposes, and denies to study the social and institutional forces which influenced and shaped these individual preferences and purposes. This turns the doctrine into a reductionist one, since it locates the individual outside the social sphere. By the same token, the problem of methodological collectivism is that social structure is taken to have an independent existence as a ‘social fact’, external to and forcing upon the individual. Social activities tend to be regarded as merely collective phenomena from which stable social relationships can be reconstructed. As a result, in such methodological collectivist approaches economic behavior is explained by converging to exogenous variables.

major concern of the embeddedness approach is on explaining how individual interests are created, sustained, and transmitted through time and space. This is intimately linked with concepts such as interdependence and coevolution.

Treating the environment as a 'social fact'

The exposure of analyses and theories that bestow explanatory primacy to social structures -- like, for example, traditional contingency theory -- is that they incline in the direction of structural functionalism in which social structures are taken to have deterministic power over individuals and firms. In such an approach the social structure is taken to have an independent existence as a 'social fact', external to and forcing upon the individual. A pertinent danger in this kind of analyses is that action is only explained in terms of groups characterized by the possession of certain emerging properties. Ontologically this implies that social structures exist *outside* of or external to individual actors. This is an omission because it neglects the fact, and does not incorporate into the theory or its applications, that the social would not exist without the actions of individuals and firms.

A firm-centered approach

What was said about making the social primary can be said about theories and analyses in which firms abide center-stage. Such studies are quite common, especially within the strategy and learning literature as well as within modern organizational economics. Notions such as, for example, organizational culture, distinctive competencies, or organizational learning are assumed properties of the firm (that is, as a collective), and not of the individuals, and the relations between individuals, within the firm. A lot of research have simply analyzed individual responses to such topics and have thereby confused the question of levels in social research. But all learning takes place inside the heads of individuals. As a consequence, firms learn only (a) by the learning of its members and/or (b) by ingesting new members who have knowledge the firm didn't previously have (Simon 1991: 125).³ Similar arguments can be validated regarding organizational culture and distinctive competencies.

In addition, such analyses are disposed either to infer that firms have comprehensive capabilities to make rational choices, or to conjecture a universal, unsubstantial omnipotence which enables authorities to cultivate without insubordination. Such analyses are inapt to uncover the range of variation within which rational choices are likely to vary, the sources of the problems it must solve, and the causal powers of individuals. Still, it is important to incorporate the firm as a distinct level of analysis. Evidently, there are several phenomena that only occur in firms (or in organizations more generally). Examples are employing, management, authority, integration, and collective decision-making to mention but a few.

Individualistic explanations

The risk of making individuals principal is the contingency for composing open-ended, solipsistic, and voluntaristic explanations with regard to the understanding of social structures. Such an approach risks being either unjustifiably subjectivist, constructivist, and interpretive or to propose

³ Here, of course, the issue of the boundaries of the firm becomes central. As often stated, cooperative arrangements between two or more firms blur the boundaries of the firms so that it makes sense to count the members of one firm as inside the boundaries of the other firm(s) with which the firm is cooperating. A suitable analytical countermove, of course, could be to focus on activities instead of on firms.

hypothetical, objectivist representations of the human nature which are invariable and context independent. Ontologically this states that individuals are always free to choose any description of reality, act according to a free will, and create the social conforming to preferences.

Granovetter clings to a middle-ground. Social structures, in his view, put limits to human action but they do not determine it. Social structures are conceptualized not just as obstacles to action but as essentially implicated in its making. The embeddedness approach is an explicit attempt to combine abstract dimensions and (enabling and constraining) contextual forces with process properties stressing action and individual perception. The social is not just a stimulus environment but an embedded composition of social relations, social structures, and individual actions. Granovetter (1992: 47) argues that institutions are socially constructed. They result from the actions of individuals embedded in networks of personal relations with both economic and noneconomic goals, but at the same time institutions continuously feed back on individual behavior and action.

The Embeddedness Approach in Business Studies

Many studies of the embedded business firm emphasize social embeddedness as an independent variable and thus overlook the importance of degree of embeddedness.⁴ Also, they become focused on structure and come short of perspectives on action. Most of the studies do develop a contextualized concept of strategy and of the business firm, they do acknowledge the multi-level quality of economic behavior, and they do question the idea that social context is an exogenous force. They do so, however, with a preference for ontology, that is, in highlighting the constitutive role of embeddedness they generally treat the social as a 'fact' that is not changed as the result of the business firm's activities. This is, of course, one reasonable (partial) approach to explaining economic institutions and the actions of the business firm, but it leaves out the epistemology of subjectivity, meaning, and agency. One result is an inability to explain firm heterogeneity and variations in economic relationships. Ideally, attention should be on more complex and complete explanations that link micro to macro and account for the ways in which the various levels of explanation interpenetrates. Moreover, institutional analysis must better account for change and the emergence of novel institutional structures and this may require a more complex theory of action (Hirsch and Lounsbury 1997: 415). An explanation to these issues requires building an evolutionary theory of economic relationships.

⁴ See Introduction for some representative references.

Embedded Technological Innovation in the Danish Road Haulage Sector

Empirical research in the transport industry predominantly uses formal logic based somewhat on traditional reasoning in industrial organization (see, for example, Button 1993; Löfsten 1995). As a consequence, inquiry into the dynamics of the transport firm and its external relationships has at large been neglected as an area of research. This may be justified concerning the structure and competencies of small independent road hauliers who have to compete on spot market terms. It can hardly be justified, though, for medium-sized, innovative niche firms or for the large, professional and highly visionary M-form corporations that dominate the sector regarding innovative activity and overall organizational evolution. The study of technological innovation in transport is of particular interest to scholars of industrial economics and organizational dynamics because of the increasing environmental demands on transport firms and because of the developments in logistics. Especially the development in logistics is related to the developments in new information technology, the increase in the volume of transported goods, the shift to faster means of transportation, and the continuing reduction in physical and trade barriers between countries and companies (as brought into existence by, for example, the development of the EU, the integration and structural transformation of Eastern Europe, deregulation of the sector within and between countries, the development in international standards, and so on).

This section explicates on interview material from a multiple case study of transport firms localized in the 'Triangular Area' of Central Jutland, Denmark. Twelve freight transport firms specialized for road haulage constitute the sample for this study. All the respondents are in managing positions either as forwarding agents, logistical managers, presidents, or owners. The firms vary both with respect to size and to market niches. One of the firms has less than twenty employees while the biggest firm has about five hundred employees. Most of the firms lie in between with an average of approximately one hundred employees. The firms operate within different but related areas such as forwarding of export goods, carriage of volume goods, carriage of construction elements both domestically and internationally, and transport of parcels. Results from this study are reported in Nielsen and Sornn-Friese (1997), in Sornn-Friese (1997, 1998), and in Sornn-Friese and Skarnvad (1997).

Technological Innovation in the Danish Road Haulage Sector

Studies of technological innovation in the Danish road haulage sector (Sornn-Friese and Skarnvad 1997, Sornn-Friese 1997, 1998) exemplifies technological innovation as embedded economic action.

There are three general levels of the road haulage operation that can be distinguished with respect to technological innovation in road freight transport (Giannopoulos 1994: 71). Technological innovations at these levels are mainly concerned with increasing efficiency and safety of operation.⁵ The first level is the long term freight operations management and logistics function. This includes order processing, cost control, statistics, the monitoring of cargo, and general finance and administration. The second level is fleet management which includes functions such as route planning and vehicle scheduling, vehicle dispatching, and vehicle fleet monitoring and control. The third level contains the functions that deal with the vehicles themselves and the goods carried. This includes route guidance, trip planning, technical monitoring and control of vehicles and cargo, consignment

⁵ Continuing innovative search for economies in transport has revolutionized transport since the 1960s. The most notable innovations for economies in transport made by manufacturing and transport firms have been an increase in bulk carrying and unit load capacities (for example, by means of specialized bulk carriers, containerization, palletization, barge carriers, roll-on roll-off systems, and by the packaging of timbers), the growth of the mega-carrier (door-to-door deliveries by combination of multiple modes of transportation), groupage (assembling by specialist firms of goods from more than one shipper into single unit loads), and the streamlining of documents by 'aligned systems' -- especially EDI -- in which a variety of documents is produced from a single master document (Bensen et al. 1994: 10).

identification, and maintenance scheduling. From an embeddedness point of view EDI (disregarding its level of technological refinement) is the most interesting -- and for the firms involved also the most challenging -- technological innovation with respect to these levels. This is because EDI is a device for the coordination of economic activities within and across firm boundaries and it is simultaneously an operational and an organizational innovation. EDI is operational in the sense that it is concerned with the flow of information associated with the movement of goods, and an organizational innovation in the sense that it concerns the relationship between the purchaser and supplier of transport and logistics services and, thus, has implications for organizational form.

Technological innovations in the Danish road haulage sector are basically incremental (based on accumulated complementary competencies); team-embodied (involving manual labor employees, owners, operators, and submanagers and forwarding agents); they are based on dialogue; and they are very much oriented towards customer needs and demands. In general, innovation takes place both within the single road haulage firm; horizontally between two or more road haulage firms; and vertically between the road haulage firm, its subcontractors, and its customers. Some of these relationships are market based, others are non-market based relationships. Thus, technological innovation processes are embedded in internal and external social structures that differ from those of the traditional neoclassical market.

The incremental is seen in that innovations are based on well established (often distributed) organizational competencies and routines and that it is often customer demands and needs or the direct commitment by employees that motivate the innovative activities. Most often innovations are new variations and combinations of the foregoing services offered by the firm. The customer orientation is seen in that it primarily creates new business opportunities with existing customers by using existing competencies and technologies in new combinations. The customer orientation typically centers around specialized market niches. Increasingly, proximity to customers is the key word in innovation processes and the philosophy for doing business is that information and knowledge from and about existing customers is more valuable than promotion for new customers. A likely (functional) explanation could be that the services offered across the different transport firms are relatively alike and that the firms, therefore, are having difficulties in differentiating from each other on known dimensions of competition, for example, price and marketing.

Innovation in Danish road haulage undertakings is a continuous process that crucially depends on the firms' unique resources and competencies. The process is a learning process that involves large parts of the single undertaking -- from owners, operators, and forwarding agents or sub-managers (that is, those persons who, on a routine every day basis, are planning the load and route of vehicles and who are consigning with the customers) to manual labor employees (for example, drivers and warehouse, packaging, and light assembly personnel).⁶ The manual labor employees are essential for the undertaking of transport activities, and increasingly so as road haulage firms evolve and the demand for complex logistics services increases.

Tacit knowledge is an important element in these learning processes especially as new ideas for profitable business or efficiency gains often emerge from those members of the firms that maintain contact with customers and suppliers on a routine basis, that is, forwarding agents and manual labor employees -- especially the drivers. As one manager puts it: "It is people that have to deal with it ... the final forwarding of goods is done by persons. I think this will always be the case. We have our employees and they are our most cherished resource. It is people whom possess the knowledge and run the business, and we will do everything in our control to keep them with us." The focus on the strategic

⁶ In road haulage firms the tasks and positions of owners, operators, and forwarding agents/sub-managers are often overlaying, done by a single person or by a limited number of persons. Many road haulage firms do not even annotate or maintain formal management positions.

important role of the employees is made more clear inasmuch as the work environment typically is seen as essential for the exploration and exploitation of individual and group competencies. It becomes even more clear in that several of the interviewed managers emphasize that they have highly motivated employees and that motivation is regarded as a significant personal attribute. Finally, staff meetings, information meetings, and evaluation meetings are quite common in all the interviewed firms. Another of the interviewed managers says: "Of course, having the same people for as long as possible is invaluable to the company. We just have to mention the customer's name, then immediately our employees will know all the accurate and customer-specific procedures."

The Embeddedness Dynamics of Technological Innovation

The innovation process often cuts across the boundaries of the single undertaking. To develop new services or enhance efficiency road haulage undertakings often engage in long-term cooperative relationships with other undertakings, suppliers, customers, and at times even governmental or municipal organizations (Sornn-Friese and Skarnvad 1997). Most often, however, cooperative relationships seem to grow out of existing relationships. This is especially so for long-term relationships with other undertakings, suppliers, and customers. As one of the respondents put it: "Three years ago we took over some of our customer's people and moved them out here with us, and then we got on-line to the customer through computers. Then we carried out all of their logistical planning and organized all their loads of goods. We reviewed all their sales contracts and said 'those goods go with this load' and then sent a message via computer to their warehouse manager: 'Find this and this and load it on our trucks, we'll be there tomorrow at two o'clock.' [...] But that is only part of the story. After a while one also takes over things like warehousing and taking care of, ...well everything! And it is all organized around EDI."

The purpose of long-term cooperative relationships is typically to get access to critical complementary resources, information, and competencies. The possible gains from learning does matter for the firms' decision to engage in cooperative relations, but learning economies are typically of a secondary concern when actually considering entering new cooperative relationships in innovation projects. The primary objective is to enhance efficiency through scale economies. Learning economies, however, is typically an unanticipated effect of such cooperative relationships that leads to further innovation and possibilities for efficiency gains. Some authors have pointed out that this is due to the causally circular or co-evolutionary nature of the interrelationships between transport and communications on the one hand, and organizational and spatial structures on the other (Capello and Gillespie 1993: 46).

The study also shows that the type and degree of embeddedness matters for innovative activities within the sector. Nielsen (1997) identified three types of road haulage firms embedded to different degrees covering a continuum from integration towards disintegration of transport and related activities. The three types are the partner firm (the most embedded), the regular carrier, and the independent carrier (the least embedded).⁷ These intermediate forms between markets and hierarchies are much similar to Lundvall's (1988, 1993) organized markets.

The type and degree of embeddedness tends to be positively related to the level and upgrading of distinctive competencies in the transport undertakings. In other words, the level of competence in the transport firms is dependent on economic relationships. The stronger the coordination with customers and the more complex the services offered the more are distinctive competencies not only measurably, but also distinctively outwardly oriented and with a greater emphasis on the exploitation

⁷ The partner firms is in fact only quasi-integrated, that is, from a contracting perspective the partner firm is a hybrid form of economic organization and not a hierarchy. According to Blois (1972: 253), quasi-integration is defined as when the firm is "gaining the advantages of vertical integration, without assuming the risks or rigidity of ownership."

and development of new information technology, business concept, and complex organization.⁸ The outward orientation is captured by the increasing importance of competencies that secure the transport firms' efficiency, quality, service level, reliability, and flexibility toward the customers. The lesser embedded transport firms mainly use information technology for internal purposes. There, the use of communication systems is limited to GSM cell phones in vehicles used for carriage of export goods and to fax and telex, that is, relatively user friendly technology with a low degree of complexity. The higher the degree of embeddedness the more complex and interdependent technologies are developed and used, for example, bar coding systems, EDI, and communication by way of satellite.

⁸ Until recently, innovation in the transport sector has tended to occur mainly in upstream activities rather than in management and organization, that is, most earlier innovations are found in rolling stock and vehicles (Frybourg 1994: 10). Hence, progress in the transport sector is technological rather than organizational and conceptual even though considerable potential exists in organization and services.

Elements of an Evolutionary Theory of Economic Relationships

The development of an evolutionary theory of the firm over the past two decades have grown out of a dissatisfaction with the ability of neoclassical economics to explain technological change and the role of the business firm in generating dynamics through intentional and purposeful action. In the following I propose an evolutionary framework for addressing the social embeddedness of economic activities in which economic action and behavior, information sharing and diffusion, learning, and adaptation in cooperative relationships are all important elements. The main point is that economic relationships have to be analyzed as organizational devices for the coordination of heterogeneous learning processes by business firms endowed with firm specific 'core' and 'distributed' competencies, capabilities, resources, and access to information. The proposed framework might not be useful for studying all types of business firms and industries, but it seems appropriate for studying the modes of organization of entrepreneurial firms and sectors, industries, and communities that rely on social relationships to function. Examples are lean strategy subcontracting (as opposed to arm's-length subcontracting); high-technology networks; third party contracting; industrial districts; and so on. Often these modes of organization are distinctive for certain types of firms and industries.⁹

To build a more complex and complete evolutionary theory that links micro to macro and accounts for the ways in which the various levels of explanation are nested requires us to return to the initial formulations of Granovetter's embeddedness approach. Such an evolutionary theory necessitates a focus on social relations and structures and it must have a notion of mutualism that allows for intentional, purposeful, and intelligent agents as well as economic and social institutions as endogenous forces that constrain and enable action. The status of agency is preserved, but it is no longer possible to see agents as creators; they are more appropriately viewed as reproducers and transformers.¹⁰ The way the firm evolves is not a deterministic outcome of its couplings to its environment. These couplings themselves are a critical management choice decision. Choices provide managerial discretion over the evolutionary path that the firm takes. This implies reconstructing the notion of agency as basically situational and relational, that is, each business firm has distinctive competencies and each faces unique constraints and opportunities.

One major point is that not all activities are equally embedded; as the study of technological innovation in the Danish road haulage sector showed embeddedness of economic activities increases with increased complexity in the context to which the specific firm is subject. For example, the sale of simple, standardized transport services are less embedded (and needs less embedding)¹¹ than the sale of more complex and customized logistic services. Also, it has been stated that the procurement of logistical services is becoming increasingly relational (Bowersox et al. 1989), and therefore it can be argued that transport service agreements in the aggregate are becoming more embedded (and needs more embedding). Also, the degree and type of embeddedness influence organizational form. Examples of different organizational forms in road haulage is 'own account' (transport as in-house activity in manufacturing firms), independent hauliers, formal and informal horizontal and vertical alliances.

⁹ A prominent example of an industry that rely heavily on social relationships to function is the European furniture industry (see, for example, Lorenzen 1998).

¹⁰ It is important to note that the reproduction or transformation of social activities is a skilled accomplishment of active subjects, not a mechanical consequent of antecedent social conditions.

¹¹ A normative point not to be pursued here.

The Mechanisms of Evolution

Much of the literature on business firm evolution is focused on describing and explaining the generative mechanisms that generate the paths of history. At the environmental level these include transmission, variation, and selection (Nelson and Winter 1982). At the levels of organization and individuals they include reproduction, learning, choice, imitation, and competition (March 1994: 40).

To further the discussion on degrees of embeddedness it is important to make a distinction between two fundamentally different kinds of evolutionary processes characterized by different generative mechanisms: Darwinian processes based on the mechanism of natural selection and Lamarckian processes generated by adaptation. Most evolutionary theories -- especially ecological theories and the new institutional theories of organizations -- see selection as the most important mechanism driving evolution and emphasize highly uncertain organizational environments, whereas much of standard organization and economic theory stress Lamarckian evolution.

In pure Lamarckian terms evolution is activated exclusively by external environmental change, rather than mutation and selection acting on variety. The environment, in the Lamarckian sense, is strictly external to the firms involved imposing itself primarily through scarcity, that is, the ties or couplings between the environment and the firms are strong. Within the organization literature the idea is vital in the contributions of Lawrence and Lorsch (1967), Pfeffer and Salancik (1978), Thompson (1967), and others. Within the economics literature the idea is present in, for example, the structure-conduct-performance paradigm, in the resource-based theory of the firm, and in transaction cost theory. Given competition among intentional actors trying to cope with uncertainty, rationality leads to optimal behavior that is solely determined by the environment.

In an embeddedness approach such exogenous changes are secondary (they do, of course, occur). Change is largely due to the activities of the agents themselves and, thus, the sources of socio-economic evolution are to a relatively large degree endogenous. In fact, it is not evident why change from some environment external to the socio-economic system should be altogether sensational or proficient to provide change or variety. Hence, an evolutionary theory of economic relations emphasizes both Darwinian and Lamarckian evolution. Which of the two that dominates depends on the type and degree of embeddedness, that is, the situational and relational aspects of particular economic activities.

The Significance of Economic Relations

The explanatory specificity of Granovetter's embeddedness concept is its qualification as a 'linkage' concept that transcends the dualism of abstract dichotomies such as, for example, structure--agency and economic--social. Through economic and social relations individual actors are linked to the material and structural elements of social context and via this linkage the processes that occur on both these analytical levels are impelled and organized.

Embeddedness denotes the mechanisms and processes of institutional change and therefore an adequate understanding of economic institutions requires detailed attention to the mechanisms and processes of the social construction of institutions. Moreover, if economic action is embedded in networks of social relations, it is logical to begin the analysis by exploring the nature of those

relations (Granovetter 1993: 3). Individuals and firms do not adapt directly to larger social environments, but to concrete ongoing exchange relations. There are three reasons for this (Meyer 1994: 111). First, individual adaptation to the overall context presupposes some sort of social stability or -- in the language of economics -- equilibrium. Since in the real world we have multiple equilibria and sometimes no equilibria at all, adaptation to the overall context would yield the antithesis of ordered action otherwise crucial to evolutionary reasoning. Second, regardless of our understanding of the overall context limits to rationality would still impede effective individual adaptation. Third, assuming away limits to rationality and the inchoate features of the economic and social context, individual adaptation to the larger context is impeded by the absence of feedback.

In other words, the world has inherent elements of randomness and our knowledge about the world is dismal. Therefore, individuals cannot predict the consequences at higher levels of aggregation of their actions. Locally or relationally, however, we can better predict and thus avoid the negative consequences of our actions. In concrete ongoing relationships trust and a mutual understanding of the needs, problems, and capacities of each other gradually evolves often with the result that our perception of this uncertainty is reduced. Therefore, economic actors are likely to engage in learning activities that are close-in to local arrangements for economic coordination. This can be restated in evolutionary terms: The higher the degree of embeddedness the lesser the element of randomness in search and learning processes. My study of innovation in the Danish road haulage sector provides a useful illustration. One aspect of knowledge as it occurs in the interviews is that, apart from being something that characterizes the individual employee, it is strongly developed through dialogue and in a stimulating work environment. This means that frequent communication amongst people in specific social settings creates individual as well as shared knowledge that cannot presently be codified. Several of the respondents emphasize group organizing and team-work within the organization and one of the respondents stresses that individual cooperative behaviors and skills are very important elements of group organizing and team-work. Particular groups or teams take care of distinct tasks in the individual firm (such as forwarding distinct types of freight or being responsible for the organizing of certain areas or routes of distribution) and continuously exchange information with each other and, thus, build knowledge that is tacit and specifically linked to the economic activities of the firm. Under these conditions it is perceived important to "build a team that operates both socially and professionally efficient."

Focusing on ongoing economic relationships must not, however, make us forget the structural aspects of embeddedness. These are still important "because it is easy to slip into 'dyadic atomization,' a type of reductionism" (Granovetter 1992: 33). The message here is that when focus is on economic relationships these relationships should not be abstracted out of social context. The nature of concrete ongoing economic relationships are typically linked to the wider social context in important non-obvious ways. Again, my study provides a useful illustration. Access to external complementary competencies crucially depends on the level of embeddedness in economic relationships. In general, when a road haulage firm offers complex services and is highly coordinated with its most crucial customer(s) the firm seems also to be cooperating with other road haulage firms in horizontal networks. Furthermore, they often outsource transport activities to hauliers operating on spot market terms (independent carriers) on either a regular or an infrequent basis. None of the independent carriers in the study engage in networks or outsource to other road haulage firms. Regular carriers typically both use independent hauliers and are participating in informal horizontal networks. Outsourcing of transport activities from one road haulage firm to another road haulage firm (typically from a regular carrier to an independent carrier) is used as a strategy to reduce costs by turning fixed costs into variable costs, to face sudden changes in demand, and to increase overall flexibility. Partaking in horizontal networks is an attempt to get access to external complementary competencies, and the more embedded the firm the more complex, tacit, and knowledge intensive are

these complementary competencies. The most embedded firms emphasize admission to structural aspects such as international distribution systems, context dependent sales knowledge, marketing channels, and terminal experience.

Mutualism in Economic Processes

Implicit in a relational conception of embeddedness is often a notion of mutualism. A logically consistent relational approach must allow for an understanding of both social adoption and actors adaptation. This idea is essential in post-Aristotelian developments in evolutionary theory with its emphasis on endogenous environments and socioeconomic dynamics as processes of mutual adaptation (or coevolution) between the evolving unit and its environment as well as between institutions (March 1994: 43, Nelson 1998). These mutual adaptations are mechanisms of socioeconomic coordination likely to lead to economic and social institutions that are not uniquely determined by the initial environment.

Mutualism is commonly taken to be the equivalent of cooperation and the opposite of competition. Mutualism is defined as occurring when the behavior of one party enhances the interests of another party, and consistency across time and across units are seen as crucial for mutualism to take place (Miner 1994: 83). There is no logical reason, however, why mutualism cannot include competitive behavior and variation. Competition is an integral part of all evolutionary processes and can, of course, be a necessary and sufficient condition for variation. A certain amount of rivalry or conflict may indeed stimulate economic action and organizational cohesion as well as lead to new opportunities and inventions. This can, however, emerge from cooperation as well. There is a body of empirical literature on national systems of innovation that focuses on variation and change as basically the result of processes of knowledge creation through mutualism (Freeman 1991, 1992, Lundvall 1988, 1992, 1993, Nelson 1983). This is made explicit in the concept of interactive learning (Lundvall 1993). I suggest that mutualism is one way of balancing variation and retention (or consistency). Like embeddedness mutualism is a relational concept, but the level of abstraction is lower for mutualism than it is for embeddedness.

Mutualism highlights the importance of human intelligibility, information processing, and action. To analyze the evolutionary dynamics of economic activities it is necessary both to consider agency and organizational routines (Shapira 1994: 122). Actions depend on firm specific routines that are largely the outcomes of knowledge-creation through the processing of complex information.¹² Economic actions are often motivated by the new opportunities for profitable business that constantly arise in economic relationships. In the economics and business literature explanations for the origin and growth of strategic alliances and other types of industrial networks are usually related to the motives of firms seeking to cope with growing complexity and uncertainty, both in terms of changing market structures and technological development (Hagedoorn 1993: 120). Explanations typically center around the costs and uncertainty surrounding R&D; the pursuit of market pre-emption strategies; advanced interfirm technology transfers; the strategic exploration of new markets and market niches; the temporal advantages of interfirm collaboration in innovation -- especially product innovation; and the monitoring of new technologies and business opportunities. These motivations are related to two fundamental aspects of embedded agency: Its situational and relational character (Storper 1998: 12).

¹² Routines and knowledge are not purely the outcome of processed information. Beliefs are also important parts of routines and knowledge (Fransman 1998).

Actions are situational in the sense that they are inherently associated with objects, circumstances and events, and individual persons, whose mixed natures create complex and particular synergies. Economic actions are relational in the sense that most actions are effective so as to allow economic coordination only if they are met by certain kinds of mutually compatible actions by other interdependent actors. By the same token, when effective economic coordination is achieved mutual expectations have been aligned.

Because of the situational and relational nature of action, action is associated with a fundamental kind of uncertainty that can only be limited or overcome by the individual agent if the agent is able to identify the aspects of a situation that are in congruence with other interdependent agents' identification and beliefs of what can and what should be done. Such mutual adaptation depends on a common or shared social context that allows individual actors to reduce fundamental uncertainty. It is special (economic) trial-and-error behavior of business firms trying to cope with an ever-changing world. In this respect, the transfer of routines and the sharing and diffusion of information and knowledge within economic relationships are key elements of economic coordination and control essential for our understanding of economic action and the evolutionary dynamics of firms and industries.

References

- Baum, J. A. C. and Oliver, C. (1992) 'Institutional Embeddedness and the Dynamics of Organizational Populations', *American Sociological Review*, 57, (August): 540--559.
- Benson, D., Bugg, R. and Whitehead, G. (1994) *Transport and Logistics*, New York, London, Toronto, Sydney, Tokyo and Singapore: Woodhead-Faulkner.
- Bhaskar, R. (1989) *Reclaiming Reality. A Critical Introduction to Contemporary Philosophy*, London & New York: Verso.
- Bowersox, D. J., Daugherty, P. J., Dröge, C. L., Rogers, D. S. and Wardlow, D. L. (1989) *Leading Edge Logistics. Competitive Positioning for the 1990's. Comprehensive Research on Logistics Organization Strategy and Behavior in North America*, Oak Brook, Illinois: Council of Logistics Management.
- Burgelman, R. A. (1991) 'Intraorganizational Ecology of Strategy-Making and Organizational Adaptation: Theory and Field Research', *Organization Science*, 2: 239-262.
- Burgelman, R. A. and Mittman, B. S. (1994) 'An Intraorganizational Ecological Perspective on Managerial Risk Behavior, Performance, and Survival: Individual, Organizational, and Environmental Effects', in J. A. C. Baum and J. V. Singh (eds.) *Evolutionary Dynamics of Organizations*, New York and Oxford: Oxford University Press.
- Button, K. J. (1993) *Transport Economics*, Cambridge: Edward Elgar Publishing Company.
- Capello, R. and Gillespie, A. (1993) 'Transport, Communications and Spatial Organization: Conceptual Framework and Future Trends', in P. Nijkamp (ed.) *Europe on the Move. Recent developments in European Communications and Transport Activity Research*, Aldershot, Brookfield USA, Hong Kong, Singapore and Sydney: Avebury.
- Cyert, R. M. and March, J. G. (1963) *A Behavioral Theory of the Firm*, New Jersey: Prentice-Hall, Inc.
- Eisenhardt, K. M. and Brown, S. L. (1996) 'Environmental Embeddedness and the Constancy of Corporate Strategy', *Advances in Strategic Management*, 13: 187--214.
- Fombrun, C. J. (1986) 'Structural Dynamics Within and Between Organizations', *Administrative Science Quarterly*, 31: 403--421.
- Fransman, M. (1998) 'Information, Knowledge, Vision and Theories of the Firm', In G. Dosi, D. J. Teece and J. Chytry (eds.) *Technology, Organization, and Competitiveness. Perspectives on Industrial and Corporate Change*. New York and Oxford: Oxford University Press.
- Freeman, C. (1992) *Technology Policy and Economic Performance: Lessons from Japan*, London: Pinter.

- Frybourg, M. (1994) 'The "imaginary" in the world of transport: from mechanics to virtual networks', in G. Giannopoulos and A. Gillespie (eds.) *Transport and Communications Innovation in Europe*, London and New York: Belhaven Press.
- Giannopoulos, G. (1994) 'Information technology innovation in road freight transport', in G. Giannopoulos and A. Gillespie (eds.) *Transport and Communications Innovation in Europe*, London and New York: Belhaven Press.
- Gimeno, J. and Woo, C. Y. (1996) 'Economic Multiplexity: The Structural Embeddedness of Cooperation in Multiple Relations of Interdependence', *Advances in Strategic Management*, 13: 323--361.
- Grabher, G. (ed.) (1993) *The Embedded Firm. On the socioeconomics of industrial networks*, London and New York: Routledge.
- Granovetter, M. (1985) 'Economic Action and Social Structure: The Problem of Embeddedness', *American Journal of Sociology*, 91, 3 (November): 481--510.
- (1992) 'Problems of Explanation in Economic Sociology', in N. Nohria and R. G. Eccles (eds.) *Networks and Organizations. Structure, Form, and Action*, Boston, Massachusetts: Harvard Business School Press.
- (1993) 'The Nature of Economic Relationships', in R. Swedberg (ed.) *Explorations in Economic Sociology*. New York: Russel Sage Foundation.
- Grant, R. M. (1991) 'The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation', *California Management Review*, 33: 114--135.
- Hagedoorn, J. (1993) 'Strategic technology alliances and modes of cooperation in high-technology industries', in G. Grabher (ed.) *The Embedded Firm. On the socioeconomics of industrial networks*, London and New York: Routledge.
- Hannan, M. T. and Freeman, J. (1977) 'The Population Ecology of Organizations' *American Journal of Sociology*, 82: 929-964.
- Hannan, M. T. and Freeman, J. (1989) *Organizational Ecology*, Cambridge, Massachusetts: Harvard University Press.
- Haveman, H. A. (1992) 'Between a Rock and a Hard Place: Organizational Change and Performance under Conditions of Fundamental Environmental Transformation', *Administrative Science Quarterly*, 37: 48-75.
- Hirsch, P. M. and Lounsbury, M. (1997) 'Ending the Family Quarrel. Toward a Reconciliation of "Old" and "New" Institutionalisms', *American Behavioral Scientist*, 40, 4 (February): 406--418.
- Lawrence, P. R. and Lorsch, J. W. (1967) *Organizations and environment: Managing differentiation and integration*. Homewood, Illinois: Richard D. Irwin.

Lorenzen, M. (ed.) (1998) *Specialisation and Localised Learning. Six Studies on the European Furniture Industry*, Copenhagen: Copenhagen Business School Press.

Lundvall, B.-Å. (1988) 'Innovation as an Interactive Process. From User-Producer Interaction to National Systems of Innovation', in G. Dosi, C. Freeman, R. Nelson, G. Silverberg and L. Soete (eds.) *Technology and Economic Theory*, London: Pinter.

Lundvall, B.-Å. (1992) *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London: Routledge.

Lundvall, B.-Å. (1993) 'Explaining interfirm cooperation and innovation. Limits of the transaction-cost approach', in G. Grabher (ed.) *The Embedded Firm. On the socioeconomics of industrial networks*. London and New York: Routledge.

Löfsten, H. (1995) *Transportation Costing for Decision Making - Transportation Industry Market Structure in Sweden and its Implications for Pricing and Costing*, Stockholm: KFB.

March, J. G. (1994) 'The Evolution of Evolution', in J. A. C. Baum and J. V. Singh (eds.), *Evolutionary Dynamics of Organizations*. New York and Oxford: Oxford University Press.

Meyer, M. W. (1994) 'Turning Evolution Inside the Organization', in J. A. C. Baum and J. V. Singh (eds.) *Evolutionary Dynamics of Organizations*, New York and Oxford: Oxford University Press.

Miller, D. (1996) 'The Embeddedness of Corporate Strategy: Isomorphism vs. Differentiation', *Advances in Strategic Management*, 13: 283--291.

Miner, A. S. (1994) 'Seeking Adaptive Advantage: Evolutionary Theory and Managerial Action', in J. A. C. Baum and J. V. Singh (eds.) *Evolutionary Dynamics of Organizations*, New York and Oxford: Oxford University Press.

Miner, A. S., Amburgey, T. L. and Stearns, T. (1990) 'Interorganizational Linkages and Population Dynamics: Buffering and Transformational Shields', *Administrative Science Quarterly*, 35: 689--713.

Murtha, T. P., Spencer, J. W. and Lenway, S. A. (1996) 'Moving Targets: National Industrial Strategies and Embedded Innovation in the Global Flat Panel Display Industry', *Advances in Strategic Management*, 13: 247--281.

Nelson, R. R. (ed.) (1983) *National Innovation Systems: A Comparative Study*, New York: Oxford University Press.

Nelson, R. R. (1998) 'The Co-evolution of Technology, Industrial Structure, and Supporting Institutions', in G. Dosi, D. J. Teece and J. Chytry (eds.) *Technology, Organization, and Competitiveness. Perspectives on Industrial and Corporate Change*, New York: Oxford University Press.

- Nelson, R. R. and S. G. Winter (1982) *An Evolutionary Theory of Economic Change*. Cambridge: Harvard University Press.
- Nielsen, L. D. (1997) 'Relationsanalysen', in L. D. Nielsen and H. Sornn-Friese (eds.) *Transportvirksomheders relationer*, Copenhagen: Transportrådet.
- Nielsen, L. D. and Sornn-Friese, H. (eds.) (1997) *Transportvirksomheders relationer*, Copenhagen: Transportrådet.
- Oliver, C. (1996) 'The Institutional Embeddedness of Economic Activity', *Advances in Strategic Management*, vol. 13, pp. 163-186.
- Pfeffer, J. and Salancik, G. R. (1978) *The External Control of Organizations. A Resource Dependence Perspective*. New York: Harper and Row.
- Porac, J. and Rosa, J. A. (1996) 'Rivalry, Industry Models, and the Cognitive Embeddedness of the Comparable Firm', *Advances in Strategic Management*, 13: 363--388.
- Shapira, Z. (1994) 'Evolution, Externalities, and Managerial Action', in J. A. C. Baum and J. V. Singh (eds.) *Evolutionary Dynamics of Organizations*, New York and Oxford: Oxford University Press.
- Simon, H. A. (1991) 'Bounded Rationality and Organizational Learning', *Organization Science*, 2, 1: 125--134.
- Sornn-Friese (1997) *En analyse af kompetence og strategisk ledelse i den danske transportbranche*, Working paper 5/1997, Copenhagen Business School: Institute for Logistics and Transport.
- Sornn-Friese, H. (1998) 'Corporate Entrepreneurship, Capabilities, and Learning in Danish Freight Transport Firms', *International Journal of Entrepreneurship*, 1,1: 89-103.
- Sornn-Friese, H. and Skarnvad, K. (1997) *Teknologiske innovationer i speditjons- og vognmandsbranchen*, Working paper 4/1997, Copenhagen Business School: Institute for Logistics and Transport.
- Storper, M. (1998) 'Conventions and the Genesis of Institutions', forthcoming in H.-J. Chang, A. C. Castro and L. Burlamaqui (eds.) *Institutions and Economic Development: Perspectives on State Reform*.
- Thompson, J. D. (1967) *Organizations in Action*. New York: McGraw-Hill.
- Williamson, O. E. (1985) *The Economic Institutions of Capitalism*, New York: Free Press.
- Zucker, L. G. and Kreft, I. G. G. (1994) 'The Evolution of Socially Contingent Rational Action: Effects of Labor Strikes on Change in Union Founding in the 1880s', in J. A. C. Baum and J. V. Singh (eds.) *Evolutionary Dynamics of Organizations*, New York and Oxford: Oxford University Press.