

The creation, operation, and change of routines in an interactive perspective

The co-evolution of firms and their information environment in industrial districts

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Abstract

This paper analyses industrial organization, decision-making and information from an evolutionary point of departure. It is argued that while routines make it possible for firms to operate on the basis of imperfect information, they are not without information costs themselves. Therefore, in populations of firms, routines may be selected according to the "information environment". The information environment of an idealized industrial district is investigated. It is seen to support certain types of routines over time. Creation and change of particular routines (learning) cannot take place without the continuous operation of other routines, a "script" for learning. Because routines selected by the information environment in a industrial district may make up such a script, the district may constitute a setting for a dynamic balance between exploitation and exploration. If so, this would account for the consistency and distinctiveness of some industrial districts.

1. Introduction

The evolutionary perspective (Nelson & Winter 1982) in economics and related fields, such as business economics or organizational science, provides great explanatory power. Relying on much more realistic behavioral assumptions (e.g. Simon 1957; March & Simon 1958; Cyert & March 1963) than neo-classic economics, and adding assumptions of learning as well as selection (Alchian 1950), the evolutionary perspective is capable of both "opening the black box" of the firm (Rosenberg 1982) and investigating dynamic processes of innovation. Thus, it is of great relevance when trying to understand industrial organization and performance. At an aggregated "population" level (Alchian 1950; Hannan &

Freeman 1977), the evolutionary perspective provides explanations and understanding of persistent (path-dependent) differences and similarities.

The evolutionary perspective owes its explanatory power to the notion of *routines*. That most firm behavior is routine-following is a basic assumption in evolutionary economics as rational choice is in neo-classical economics. The routines are treated as the "genes" of evolving industrial systems, and it is differences in dominant routines that are assumed to determine differences in organization and performance over populations of firms. The evolutionary perspective achieves its understanding of dynamics through theorizing of the processes through which routines are created and changed over time.

Still, taking an evolutionary perspective implies some problems that only to a limited degree have been solved. Firstly, the perspective pays surprisingly little attention to the very vehicle of its explanatory power: The routines that are found inside the black box of the firm. At the firm level, assumptions are made - mostly behavioral ones -, but research is to large degree neglected. With evolutionary theorists, cognitive theories mostly function as assumptions making research at the population level possible, not as agendas for research at the firm level itself. While the notion of routines constitutes a tool for population-level analysis of dynamics, analyses rarely include the routines themselves. Rather, their creation, operation, and change is left as the next black box.

Secondly, the notion of a population of firms has not been satisfactorily defined. Most often, it is assumed that the processes of routinization and learning within a population of firms are influenced by the particular institutional environment in which the firms are embedded (Dosi & Malerba 1996). However, referring to a "technological paradigm" (Dosi 1982; Dosi & Malerba 1996) as the relevant institutional environment, research within the evolutionary perspective often uses sectors or industries as its population level of analysis. This may be due to availability of statistical data, but it also shows that many evolutionary economists aim at providing "sectoral taxonomies" (Pavitt 1994, Malerba & Orsenigo 1996). Although perspectives of technological paradigms - and sectors - may prove useful when investigating the general scope for routines, they will not function to delimit institutional contexts in which processes of routine creation, operation, and change can be fruitfully studied. On the contrary, as e.g. Lundvall (1992) suggests, the institutional environment for routinization and learning should be seen as multidimensional, and may be defined by national boundaries rather than sectorial ones. Further, as Granovetter (1985) emphasizes, firms are embedded in dense networks of proximate social relations that constitute their effective institutional environment. Such relations often happen within a certain "information contact potential" (Sweeney 1991), i.e. it may be within a regional or local area (Axelrod 1984). Because "proximity matters" (Malmberg & Maskell 1996) in this respect, according to Storper (1992: 435), the relevant boundary for populations of firms could be "regional worlds", in which an institutional

environment of "... practices, routines, agreements and their associated informal and institutional forms" is prominent.

Thus, one should define a population as a number of firms that all operate within a proximate, effective institutional environment for creation, operation, and change of routines. Such an environment, I shall argue, has its influence because of its ability to pool and distribute information (I call this aspect the *information environment*). Lundvall (1988) emphasizes inter-firm interaction as an information provider underpinning learning. An important aspect of an effective institutional environment may be the inter-firm interaction and interdependency patterns. Populations that make sense to study in this evolutionary perspective are those of "industrial clusters", "development blocks" (Dahmén 1988), "production systems", maybe even "territorial production systems" (Scott 1988; Walker 1988; Crevoisier & Maillat 1991) or "industrial districts" (see Marshall 1891; and e.g. Becattini 1990; Brusco 1992). In order to understand the dynamic processes in such populations, one should depict what is going on at the interface between the single firm and its institutional environment. In short: A good way to study the creation, operation and change of routines is investigating the microprocesses of the interaction between the single firms in a production system or industrial district.

That evolutionary economists so far have been reluctant to investigation at this level may be due to their lack of tradition for qualitative research - or case research. With its offspring in neo-classical economics, evolutionary theory incorporated assumptions and arguments from behavioral studies, but did not at the same time introduce methods from behavioral science (and much less from cognitive psychology). While not arguing that evolutionary economists should become anthropologists nor conduct laboratory experiments, I nevertheless sustain that they should augment their understanding of routines at the firm level, and more importantly, local processes, i.e. processes at the interface between the firm and its information environment.

In this paper, I outline the first steps in a possible route to such an understanding (in another paper, I provide some tentative empirical findings that illustrate the possible scope of my approach). I use an idealized industrial district as an example of a population, and argue that the history of an industrial district is one of path-dependency, i.e. *co-evolution* of firm-level routines, population-level patterns of routines, and an information environment. I argue that institutionalization and change co-evolve at these levels, and that the co-evolutions are mutually determining and enforcing. I touch upon the processes at the interface between the single firm and its information environment (mainly other firms), and discuss processes of change at the firm and the population level. In section 2, I describe the evolution at firm-level: The creation, operation and change of business routines. In section 3, I describe population-level evolution: The interdependency between an information environment and patterns of routines.

2. Evolution at the firm level

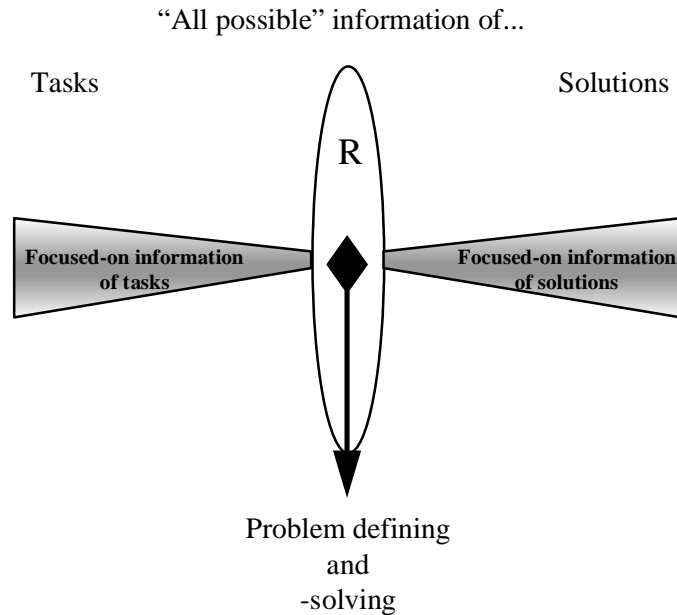
A *routine* can be seen as a prescript for action that has come about because that same action has been repeated, and its logic "internalized" to the actor(s). When created, a routine may basically be seen as an institution which defines the everyday problems one should solve. At the same time, it makes the solution to these problems evident (do as you are used to). The problems and their solution may be "economic" (if pure economic problems exist!), that is, performing economically viable actions in a business environment. They may also be "social", that is, acting meaningfully (Blumer 1969; March 1988) and socially sanctionable in a community. Thus, my view of routines is quite broad (they solve problems of economic as well as of social action). In the following, I focus on the information-processing and -demanding nature of routines. As will appear, I also have a quite non-orthodox view on information: It spans from technical knowledge to human values or norms. As I shall argue, I do this from a point of view of methodological individualism.

2.1. The information-processing nature of business routines

Firms - especially those that are small or otherwise have limited internal resources for information-gathering - can be assumed to function in a world in which information of future tasks and their possible solutions is imperfect (asymmetric and fluctuating). Under such circumstances, a firm can be seen as defining and solving problems (making decisions) on the basis of a collection of business routines that prescribe action regarding the firm's functions (i.e. producing, transacting - and innovating). Because routines make action possible even if tasks and their solutions are not given by accessible information, they represent a firm's most essential capabilities (Dosi & Malerba 1996). However, routine-following behavior is not per se optimizing, rather "satisficing" (March & Simon 1958): Allowing decision-making getting on the road instead of ending in a deadlock of attempting to achieve all "necessary" information. By applying a routine to a given problem, one instead *focuses* on particular tasks (resembling, not necessarily equaling, the tasks the routine has been applied to before), and particular solutions (resembling the solutions that have been used to work the resembling tasks before) - and match them in order to decide and act accordingly. Using the routine may not be optimal - the match may not be optimal - but it can be satisficing.

Figure 1: The information-processing nature of routines

The operation of a routine may be compared to a focusing device. A “prism” that - out of infinite and to the firm inaccessible information - focuses on and matches particular tasks and solutions to come to a decision.

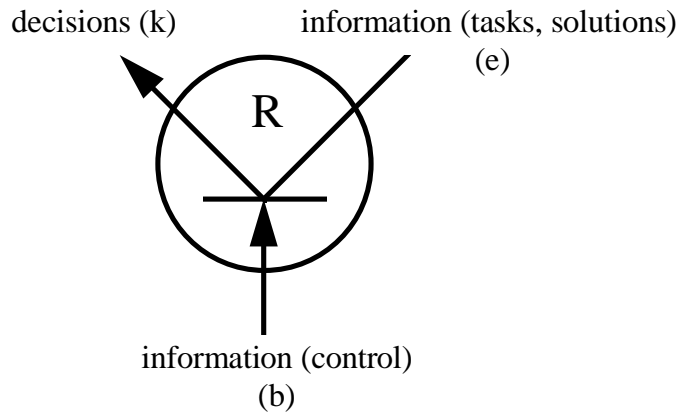


2.2. The information-demanding nature of business routines

Routines make it possible to decide even on the basis of imperfect information, because they imply a choice to focus on particular information. However, specific auxiliary information is needed to guide such focusing. Typically, the routines will not operate unless provided particular, quite stable, information inputs. The nature of these auxiliary inputs is not of the sort that orthodox theory prescribes for decision-making. It does not relate directly to the “technical requirements of the task at hand” (Selznick 1957) - it is not used for the decision itself, but for the operational logic of the routines. The specific information inputs that a routine needs function as its "control base".

Figure 2: The information-demanding nature of routines

The operation of a routine may be described by analogy to a “transistor”: It is able to control the flow of focused-on “technical” information (the “emitter”) that is used for making decisions (the “collector”) by a “weak” flow of “control information” (the “base”). Fluctuations in the information used for control may have great impacts on the functioning of the routine, whereas it is relatively invariant to fluctuations in information to the “emitter”.



Which control information inputs a routine needs to operate depends closely on which behavioral logic the routine constitutes. E.g. a routine that prescribes “only to cooperate with partners one trusts”, saves a manager the expenses of achieving all possible information of all possible partners. To operate, this particular routine in return needs information inputs that make it possible to judge the trustworthiness of potential partners. This information can be e.g. gossip of the actions of others that may or may not make them “sensible” (Blumer 1969; March 1988) or sympathetic in the manager’s world view - and thus, according to the nature of the routine, form the basis for trust. This information seems irrelevant for making rational-choice decisions of cooperation. But unless it is easily accessible, “only cooperating with people one trust” makes little sense - because one has not the possibility of getting to trust anybody. In that case, decision-making will be paralyzed.

What can be seen is that decision-making does rely on information inputs that are stable, unlike the fluctuating information of possible tasks and solutions. This does not mean that access to this information is easily available on the market. As I will show later, access to such information may well be discriminating and depend on the “historical belonging” of firms to an information environment. Trough historical development of a firm’s routines, they have become “situated” - i.e. they cannot be transferred to other contexts (or firms) - because the specific control information inputs that they make use of make little sense in other contexts or even to other actors. This is quite different from the perfect information required by orthodox decision-making, which - if it existed - could be used in all contexts, for all tasks. The specificity and non-market nature of the information control base of routines is what makes them so invariant to fluctuating tasks and information on the market.

2.3. The tacit nature of business routines

The routines operate on the basis of specific information that cannot explicitly be related to the “task at hand”, the decision, because decision-making through routines is not explicit, it is “institutionalized” (Selznick 1957; Scott 1995). All action within a firm cannot be viewed as conscious, based on explicit incentives. Some action can be guided by regulative institutions (Scott 1995), that is, written or otherwise formalized rules, regulations and practices. Incentives for such action may be understood by principal-agent theory. Routines, on the other hand, constitute guidelines for behavior of normative (March & Olsen 1989) or even cognitive (DiMaggio & Powell 1983) nature, and routinized behavior is to a degree automatic (Shriffrin & Schneider 1977) to individuals in the firm, that is, it is less conscious, based on incentives that is internalized or tacit (Polanyi 1969), like habits or norms (Elster 1989).

2.4. The creation and change of business routines

These guidelines that make up routines are tacit, because they are created in a process of situated learning-by-doing. Through experience, the guidelines arise as procedural knowledge that is distributed (no single actor can comprise it all) and that cannot be formalized (it may even not be recognized, and much less codified, by the persons holding it). The routine-creating process of learning-by-doing is one of trial-and-error: *Creating* or *imitating* (from other firms) *varieties* of action on particular problems and subsequently *selecting* the best practice. In repeated rounds of trial-and-error, it is likely that *adaptation* to the relative best practices will happen. Even if practices is imitated from other firms, some adaptation is likely to be necessary.

Routines are always learned and applied on the basis of other routines. When *applying existing routines* to new problems that resemble problems that have been solved before, a firm needs routines of how to decide whether the application is “reasonable”. When *learning new routines*, it needs routines of how to evaluate or select in order to decide whether a tried practice is sufficiently efficient to be continuously applied. And finally, *abandoning or changing existing routines* must be done in a trade-off between “exploitation” (the augmentation and refinement of existing routines) and “exploration” (shifts or creative destruction of routines)(March 1991).

One might say that if single routines make up conceptual focusing devices, the entire collection of routines in a firm make up a “script”, a “conceptual network” (Schank & Abelson 1977). Single routines prescribe action at the single “nodes” of the script. Through exploration, single routines may be experimented with and changed - but a firm can only do so because some other routines in the scripts are held constant. One cannot change everything at the same time. For example, to change certain routines in interaction with other firms is only possible if a firm sticks to business as usual on other areas to bear the initial expenses of the

interaction - the transaction costs (Williamson 1975). Further, it may need to rely on the routinized expectation that it is beneficial to interact - otherwise the learning of routines - the dynamic transaction costs - may seem to be destructive (Langlois & Robertson 1995). Thus, total "unlearning" - creation of new routines or change of old routines into new ones that have nothing to do with the old - is both unrealistic and undesirable. Rather than unlearning, finding an appropriate balance between exploitation and exploration is one of the greatest challenges to a "learning" or "knowledge-creating" organization (Nonaka 1995). Later in this paper, I shall discuss which routines firms in an industrial district may hold constant while changing others.

It follows that the process of routine creation and change hardly can be one of planning (Langlois 1995). Rather, routines arise spontaneously or "organically" (Menger 1963) in a firm. Further, because routines tend to be built upon other routines, the routine-creating process is cumulative (path-dependent) - and the evolution of a single firm irreversible. Below, I shall discuss possible reasons for equally path-dependent patterns of particular routines to evolve in populations of firms. First, I shall elaborate on the institutional environment of the sort of population I choose to focus on.

3. Co-evolution at the population level

In the following, I discuss the evolution of institutional features on population-level. As argued in section 1, a potentially fruitful population size - and institutional frame - may be that of "industrial districts". In the following, I choose to use an idealized such district as a hypothetical example for my discussion. It may be useful because of the status of most industrial districts as production systems with a high degree of firm interaction, because of their strong constitution of political and other public institutions - and because of their often long histories of industrialization.

In populations of firms "with a history", many institutions of importance may have evolved. I focus on what I call an *information environment* of the population. The information environment that have co-evolved with a population of firms will be shown to be of great importance for both the creation, operation, and change of routines. The nature of the information environment may thus be the explanation for dominant patterns of routines in the population. At the other hand, the (routine-guided) patterns of action by the firms in the population is what have to a large degree created the information environment. The mutual conditioning between the patterns of routines and their information environment indeed makes the history of a population path-dependent.

3.1. The information environment

The information environment is the ability of the institutional environment to pool and distribute information. The information may be what I have referred to as *technical* information that traditionally has been seen as required for decision-making: Information of possible tasks and their solution. This information comprises a range of signals of market conditions and -developments, technological requirements and -innovations (including human skills). The information that constitute the *control base* for routines ("beyond" what is required by traditional decision-making) may be less technical: On-line information of other actors (of their actions and of consequences of their action), i.e., gossip that make one able to ascribe motives and meanings to their action (Blumer 1969), but also more stable ideological and religious "inputs", social norms, values, etc.

Following a perspective of methodological individualism, I view all this information as basically pooled in individuals. That is why I emphasize the distribution system of information. It is such a system (which I very much equal to interaction patterns between individual agents) that make information social or "common" (by making it available to a number of actors). Similarly, the distribution system makes human values - in the sense of Weber (1978) -, norms (Elster 1989), or trust (Coleman 1986) social, by making a number of individuals adhere to a similar logic. As I shall get back to in section 3.3., this is the social function of patterns of routines in populations: They form the basis for social action. In the following, however, I shall concentrate on information and the distribution of it.

The information may be more or less codified or explicit (Polanyi 1969). Technical information, tends to be more explicit, that is, formalized and systematic as "know-what" and "know-why" (Lundvall 1996). The information that may serve as a control base for routines, on the other hand, tends to be more tacit, that is non-codified as "know how" and "know who", and thus less tangible, and difficult to understand to those that have not got the "code keys" to it (Lorenzen 1996). How the environment pools and distributes these different types of information depends on organization in a broad sense: Industrial organization, social organization, and spatial organization.

The *channels* though which information can be transferred takes on different organizational forms. Explicit information can be pooled in e.g. statistics, books, reports, databases or written procedures. It can be "transmitted" in its original or a closely related form through "hard-core" information channels. Examples are how product specifications, descriptions, or orders are transmitted through EDI, fax, reports, etc. Interaction with other firms must be seen as a major source for such information (Lundvall 1988). Specified technical information may also be purchased on the market or achieved as a public service though specialized agencies. Further, research-intensive firms depend on access to research

facilities, libraries, conference facilities, etc. More generalized technical information can be contained in formal skills, achieved through education or formalized training. Access or proximity to educational facilities may be of importance for the single firm. Tacit information is not formalized and it is embedded in individuals - as "know how" or "know who" or as even less formalized knowledge: Personal norms and values. A channel for achieving tacit information will be through hiring, as some of it, of course, will survive a change of place of work (Arrow 1973). But it is often also distributed socially (cannot be contained in a single individual) and situated, i.e. only makes sense in specific contexts. Thus, transfer of personnel does not equal transfer of tacit information. Further, this information will only be used for decision-making through routines if the hired person performs such tasks himself. Studying transfer of tacit knowledge as information signals, emphasis must be put on personal relations as information channels. Such channels can be compared to those of "weak ties" (Granovetter 1973) or "loose couplings" (Weick 1976). This can be seen as the "human" aspect of firm interactions, but also as interactions without of the purely economic sphere - between acquaintances, friends, family, etc. Thus, distribution of both explicit and tacit information frequently happens through interaction between actors - within and out of firms.

Producers in industrial districts, belonging to one or relatively few related industries, are strongly specialized in subcontracting systems with few particular user goods as final output. Thus, specialization subcontracting is frequent. Within such a production system of specialization and cooperation, the tasks that product innovation should solve are to a high degree defined by demands from customer firms. Thus, product innovations are "systemic" (Langlois & Robertson 1995), i.e. based on user-producer sharing of information (Lundvall 1988). This sharing of information is rarely limited to product design only (IMP Group 1982; von Hippel 1988). Even when capacity subcontracting - another common feature in idealized industrial districts - is concerned, inter-firm interaction can provide information sharing. As subcontracting arrangements are not only frequent but also shifting within the industrial districts, and because information is passed on to third parties, the pattern of interaction thus may make certain types of information accessible to many - if not the majority of - producers. In an idealized district, the public services and other institutions, such as unions and employers' associations, also function as interaction forums. The functioning of some public services - "real services" (Brusco 1992) - may be exactly to promote interaction and information sharing between firms. Further, such institutions may serve as efficient local distributors of technical knowledge, export services, etc.

Firms are not "black boxes" when transactions and sharing of information are concerned (Lundvall 1988; Langlois & Robertson 1995). On the contrary, successful reception and understanding of all types of information depends not only on certain channels, but also that the recipients occupy "code keys" (Lorenzen 1996) to the information. Code keys important for reception and understanding of explicit knowledge are provided e.g. by education, while more

subtle skills achieved through training are necessary to receive and utilize less explicit knowledge. Tacit information, being an “understanding” hard to share, requires even more elaborated code keys. Tacit information is not transmitted, rather “communicated” (Schelling 1960), when the participants are able to read the information intuitively, using “culture” (Casson 1991) as code key. Culture encompasses language, differences in which can lead to *misunderstanding* of the information, and more tacit components, such as norms (Elster 1989), rules (Sugden 1986) or “prominence” (Schelling 1960), differences in which between sender and recipient of the information may lead to *misinterpretation*. As Arrow (1973: 18) puts it: “No matter how much the technology of information-processing is improved, the ability of human mind and senses to absorb signals will be a permanent limitation”. Thus, the ability of an information environment depends on the interacting firms having skills, practices, language, and “culture” similar enough for the subtle elements of tacit information to be distributed.

This has two major implications. Firstly, an idealized industrial district, being an industrial “community” (Taylor 1982) of actors - and practitioners - with a high interaction frequency (Marshall 1891) and institutions that promote coherence through interaction, may constitute a very strong information environment in this respect. This is because, apart from a common language of all its actors, there exists a system of social norms (Elster 1989) and regulation (Lorenz 1992) which punish actors that do not adhere to the conventions of practice. Incentives to comply to such conventions may well be internalized through socialization. A long life of being brought up in and living within such a community provides the actors with similar reference points. In an environment of such a closely-knit community, the development of culture is profound - and cultural elements promote an information environment. This argument turns the logic of much information theory upside down: In industrial districts, tacit information can be just as - or more - transferable than explicit information.

The second implication is that it actually may be similarity of routines that promote an information environment. I argue that “culture” equals a number of actors that follow the same logic, i.e. follow the same routines (in my very broad definition). Thus, the ability of actors in firms to understand information they encounter in interaction with other firms to an extent depends on their following similar routines. Actually, similarity of routines may well be the condition for a firm to get to interact in the first place - and thus to get access to information channels - if routines in other firms prescribe only to cooperate with actors that are similar in particular aspects. If this “regulation” through routines of cooperation is a dominant one - and it may be in many communities or districts, it can be called “social”. I shall discuss my view of social regulation and social norms in more detail later.

Above, it was made probable that an information environment depends on routines of firms. Firstly, because routines decide the patterns of interaction between firms. Secondly, because they may serve as code keys - or to enhance the

code keys - that allow firms to understand the information they get access to. Now, I move on to discussing the vice versa, the other half of the co-evolution: The role that an information environment plays for the evolution of patterns of routines.

3.2. Patterns of routines

Where and when will patterns of routines arise? As mentioned earlier, the scope for routines may depend on the technological paradigm under which firms operate. In hi-tech industries, innovation though continuous R&D-efforts is necessary. Thus, the game is one of leaders and followers (Schumpeter 1934; Nelson & Winter 1982): Of proactive variety creation for some and imitation for others. Following an industrial modernist logic, the evolution of firms greatly emphasizes exploration: The continuous destruction of old routines and creation of new. Because of the following innovation costs or dynamic transaction costs (Langlois & Robertson 1995), the game is chiefly played by firms with larger resources, although small newcomers have been known to innovate their way into hi-tech markets. Adhering to this logic, patterns of routines is bound to be less pronounced in certain markets.

Even in these industries, however, some populations of firms may be distinguished, in which there is scope for patterns of routines. As outlined in section 2, even in "the learning economy" (Lundvall 1992, Nonaka 1995), there is scope for routines in the single firm. The same can be said at an aggregate level: Even on fragmented and volatile world markets, the need for continuous variety creation in order to achieve market advantages will not necessarily rule out routine-following behavior. I argue that the scope for patterns of routines not only depend on technological paradigms, but also on organization, i.e. information environments as described above. Thus, even in hi-tech industries, patterns of routines may dominate in populations of firms with no apparent leaders and followers. The patterns of routines - and routine-following behavior - seems to represent some kind of collective action (Coleman 1986). While some routines persist, variety creation happens - although in some populations at a moderate pace. A learning balance exists between exploitation and exploration that place less extensive cost demands on the single firm. Thus, SMEs can exist and innovate in these contexts.

In the following, I shall discuss possible reasons for patterns of dominant routines to arise at the population level in industrial districts. I argue that the information environment in the districts greatly influences the processes through which such patterns arise: Variety creation, selection, and adaptation.

The creation of new *varieties* that may be tried and subsequently applied or dismissed, is one of Schumpeterian "Mark I"-innovation (Schumpeter 1934). Some such innovations may of course happen though independent "mutations" (De Bresson 1987). Variety creation rarely happens, however, without an

element of search: Imitation or at least inspiration that is connected to the information environment of firms. This can be true even when R&D-efforts are high, because R&D to a large extent is about gathering and systematizing information.

That routines have information costs as mentioned in section 2.2. makes us capable of explaining under which circumstances they may come to dominate in populations of firms. If certain information inputs are easily accessible (cheap), certain routines may prevail through *selection*. On the other hand, if information of the particular sort that a routine needs to operate is scarce (the operating costs of the routine are great), the routine may change. Contrary to biological selection, however, in economics, selection in its “strong” form (the weeding out of firms that follow routines that make them inefficient relative to competitors (Alchian 1950)) is much rarer than *adaptive* selection (Nelson & Winter 1982; De Bresson 1987). Imitation or retention provides the single firm with the possibility to change routines into ones that make it relatively more competitive. Here, the selection is done between routines within the firm. Naturally, such adaptation processes demand information of the practices of others and the consequences hereof.

Such evolutionary perspectives usually emphasize the *efficiency* of routines. However, information on the markets must be seen as imperfect. Thus, as many firms export their goods out of the district, the efficiency of the single routines can be hard to evaluate. Although for those firms selling their goods locally, the efficiency of their routines may be easier to judge, generally, information of efficiency must be seen as difficult to achieve, and hence the selection difficult to make. The perspective that I propose, emphasizes the *costs* of routines. Whereas evaluation of absolute efficiency demands much and detailed information, evaluation of costs *that are induced by information availability*, only demands information about this availability. It must be seen as fairly easy to observe that certain practices are difficult or costly. If the difficulties are due to local circumstances - the costs of certain practices may even be social in the shape of social sanctions - the costs are easy to monitor. Thus, information necessary for an adaptation to what is locally more efficient, must be seen as relatively easily attainable in an industrial district. While it is impossible to achieve absolute efficiency due to infinite information uncertainty, in an industrial district, adaptation towards the local less expensive practices may be possible within an information environment.

3.3. The path-dependency of co-evolved systems

If selection - or rather, adaptation - processes lead to patterns of those routines that have the lowest costs of their control base information, certain routines that are based on tacit - but to some actors easily accessible and stable - information may come to dominate in industrial districts. On the other hand, routines that may be changed are those based on fluctuating information. In spite of the

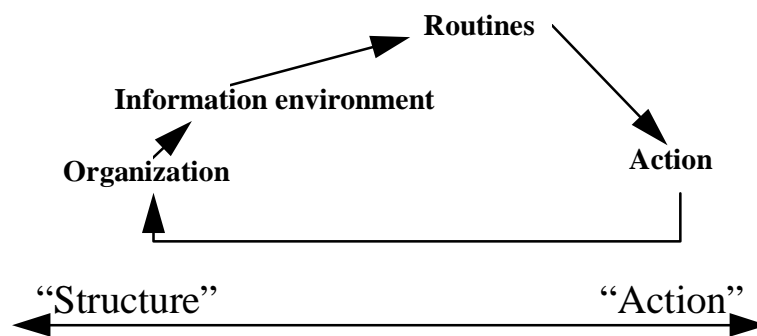
codified nature of much technical information, it is fluctuating and thus hardly achievable to economic actors in general - and to SMEs in particular. As mentioned in section 3.1., in industrial districts, it may be more easily accessible. It does not compare, however, to the abundance and stability of tacit information in some districts. On this tacit information, persistent routines may be based. Paradoxically, the routines that thus persist are those hardest to understand to outsiders, because they are based on information that is highly situated, that is, non-accessible on the market or to outsiders to the information distribution system in the district.

As already stated, in order to participate in the information distribution of the relevant tacit information, firms must adhere to social norms and conventions, i.e. follow the practices that are common in the “community of firms” or population in the industrial district. In other words, the firms need to follow routines similar to those of other firms. This implies that in order to develop routines of a certain nature, firms need to follow routines of a certain nature. Further, as a code key to some information, firm managers need to share culture and values or other knowledge that is “procedural” - it can only be achieved over a long period of time. Thus, an information environment and the patterns of routines seem to be dependent on a common history, that is, they are co-evolved and path-dependent.

As it appear from section 3.1., an information environment depends on organization and thus the actions of the individual firms. As outlined in section 1, behavior of firms must be seen as routine-following. As shown in section 3.2., routines themselves are created, operated, and changed on the basis of an information environment.

Figure 3: The path dependency of co-evolved systems of routines and institutional environments

Between the patterns of routines and the information environment, a cumulative causation relationship exists that results in path-dependency. The relationship illustrates the relationship between “structure” and “action” in a co-evolved system.



Due to the path-dependency of such a system, it may be difficult to newcomers to plug into the information distribution system and thus to operate. Firstly, because new firms simply are not allowed into the social distribution network by other firms. If interaction with other firms is not initiated, the “gate” is kept shut. Secondly, because the code key is not easily achieved due to time compression diseconomies (Dierickx & Karel 1989). You cannot learn culture overnight.

The interdependency of the information environment and the patterns of routines may lead to organizational lock-in, that is, the lack of ability to change routines, even under new conditions, e.g. on the markets. Some industrial districts, however, have continued to prosper and remain flexible. This feature is often ascribed to the learning efficiency of the firms localized in these districts (Storper 1992). Such a learning capacity seems to exist in spite of the old cultural traditions and social structure of the districts. There seem to exist a balance between continuity and change, between persistence and learning of routines (exploitation and exploration). In the perspective of the above mentioned, the learning capacity of firms in those districts may be seen as a result of the nature of the information environment in the districts. All the information that is abundant in these environments play a role.

Firstly, the (often tacit) information of the control-base type - in the analogy of routines as a “transistor” (figure 2), plays a great role. Learning must not be seen as happening in spite of the continuity of cultural and social traditions of the districts - but on the basis of it. This is so because they function as the information operation base on which certain routines continue while giving scope for experimentation with others. As mentioned in section 2.4., most firms need to stick to business as usual in some areas while experimenting with new practices on others. In districts, some routines (e.g. routines of ownership or of cooperation and trust) may be very stable, based on easily available local information (culture). At the same time, other routines (e.g. routines of where to export, what logistics to use, etc.), based on other, technical types of information, may be continuously revised and experimented with. Thus, the culture - the tacit information - in such districts constitute a “social script” for learning - a social framework, within which single firms can continue their social praxis with the approval of other local actors, while experimenting with new markets, products, or technologies. That a majority of actors have similar routines is what makes an industrial district function as a community: It makes norms social, and thus creates social conventions or rules (Sugden 1986). I argue that the conventions are just similar routines followed by a number of actors - plus an environment that provides them with their information base.

The nature of the institutions contained in an industrial district thus comprises a social system of *information*, as described in section 3.1, a social system of *selection* (the selection and adaptation processes are interactive, based on the distributed information), and - as being described - a social system of *innovation*. Further analysis could show e.g. social systems of *trust* (that groups of firms

trust each other on the basis of routines of trust that is supported by information that permits them to evaluate and subsequently to trust each other), and of social *regulation* (actors act towards each other on the basis of routines that aggregated constitute social conventions or norms).

The social space that firms create for themselves in these districts helps those with limited resources to produce, transact, and innovate. In some districts, for example, the high turnover rate of firms may be interpreted as a symptom of decline. But in some districts, firms that go bust (e.g. due to lack of adaptation to new market conditions) are frequently helped by other actors in their local environment to start anew - this time to adapt their routines (e.g. of export). For such firms, the *social* space (based on certain routines with certain information inputs) is what is important to preserve - routines of *technical* nature (based on other information) is what can be experimented with.

The abundant technical information of tasks and solutions that results from the systemic nature of the production (the specialization) in the districts also plays a role, of cause. Again utilizing the “transistor”-analogy, keeping the “emitter” information high provides the firms with more possibilities while innovating. Although information of markets may not be easily accessible, information of technical opportunities, practices, possible partners and cooperative possibilities is abundant in such a production system. Thus, the information environment in an industrial district may both support continuity and change - or combinations hereof.

4. Conclusion

In the paper, a framework for understanding the creation, operation and change of routines was proposed. In order to understand why particular patterns of routines arise in some contexts, it was suggested to look not only on the information-processing, but also the information-demanding nature of routines. Having focused on the relationship between routines and information, an institutional context for creation, operation, and change of routines was suggested. Naturally, the ability of the institutional environment to pool and distribute information was emphasized. As interaction between firms was suggested as a major information provider, environments with frequent and shifting firm interaction were suggested as potentially fruitful cases: Production systems. As industrial districts constitute such systems, and furthermore are endowed with public services and other institutions that promote information pooling and distribution, such districts were suggested as a frame for studying evolutionary processes. It was argued that because particular tacit information is abundant in industrial districts, certain routines are selected due to their information costs. The continuity of these routines constitutes a social space that allows localized firms who adhere to their behavioral logic to experiment with still other routines. Thus, the continuing patterns of routines - the culture - in

industrial districts constitute a social script for learning. The script has developed path-dependently over time.

The logic that I propose is quite contrary to that of orthodox decision-making, which focuses on the importance of the availability of technical information for innovation. In my view, technical information is seen as important, but availability of more tacit information plays a crucial role for innovation, because it supports the functioning of certain routines that serve as the basis for innovation.

The notion of routine operating costs is closely connected to the notions of (non-dynamic) transaction costs. Similarly to Williamson, organizational “arrangements” (patterns of routines and following behavior) that minimize costs are predicted. However, this is done without making the problematical assumptions of transaction cost theory regarding information and behavior. Furthermore, a different analysis of the institutional environment in which firms are seen to be embedded is given. The processes through which both the institutional environment and the institutional arrangements evolve are sought described, not merely assumed. Hereby, my analysis attains its view on cumulative causation and path-dependency.

In the paper, I sail the troubled waters between economy and sociology, using the notion of information as a guiding star. The paper should serve as a take-off for case studies in an industrial district. In evolutionary economics, neither the notion of information nor of an institutional environment is new. What could be new about the approach - apart from the utilization of industrial districts as cases - is the tentative investigation of the collective learning capacities of the market - the interactions between firms. In sociology, neither the problems of populations of actors that act collectively nor of institutions constitute anything surprising. Application of game-theoretic analyses to give evolutionary explanations of institutions is not a rare phenomenon. What may be a development in this paper, however, is the incorporation of case studies and more detailed notions of information in this respect.

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