

Routines and the theory of the firm: the role of communities

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As emphasized by Nelson and Winter (NW thereafter) in “An Evolutionary Theory of Economic Change” (NW, 1982), the notion of “routine” is a key concept in the foundation of their evolutionary theory. Routines are the “genes” of the organization, and constitute the element of heredity of the evolutionary theory. Evolutionary approaches to economics is grounded on an explicit dynamic account of the interaction between mechanisms of variation (which constantly introduce variety, novelty and heterogeneity amongst routines) and mechanisms of selection (which tend to reduce heterogeneity amongst routines). More precisely, Nelson and Winter underlined two main dimensions of the routines.

- On the one side, there is a cognitive dimension when considering that routines encompass the organization’s knowledge basis and they constitute the organizational memory (“organizations remember by doing”, *ibid* pp 99).

- On the other side, there is also a motivational dimension associated with the control of intra-organizational conflict: routines are “truces” amongst conflicts (“attempts to change routines often provoke a conflict which is destructive to the participants and to the organization as a whole” (*ibid*, pp 134)).

NW also consider "routines as target" (pp.112). "Just keeping an existing routine running smoothly can be difficult. When this is the case, the routine (in its smoothly functioning version) takes on the quality of a norm or target, and managers concern themselves with trying to deal with actual or threatened disruptions of the routine. That is, they try to keep the routine under control" (pp.112). This aspect of routines is essential, because routines also play a explicit or implicit role as coordination mechanisms.

Thus, "routines" can be viewed as a condensed way to *remember by doing why to do (motivation-incentive), and how to do things (cognition and coordination)*.

The seminal contribution of NW gave a new impetus to researches on routines. From the pioneering work done by Simon and March (1958), the concept of routine mobilized researchers from various disciplines that include among others organization theory, cognitive psychology, computer programming, artificial science, etc....The NW's vision of routines, based on Polanyi's distinction between tacit and explicit knowledge (1962), contributed to anchor the notion of routine in the very center of the economic debates. Three main dimensions of research on routines have been particularly active:

- First, along a tradition that comes from the earlier works of Simon, routine is considered as the main analytical tool for the understanding of cognitive processes in organizational learning approaches. This perspective (following Argyris and Schön, 1978) leads to more practical applications and empirical studies (Cohen, 1991; Egidi, 1994; Marengo, 1996).
- Second in the pure NW's vision, routines viewed as genes of the organization in an evolutionary framework, paved the way of the neo-Schumpeterian approach of the economy (Dosi, 1988; Nelson, 1994).
- Third, as the elementary building block of the "competence-based" approach of the firm, the notion of routine is used in an ambitious attempt to restore a theory of the firm based on the production side as alternative to the dominant transaction-cost approach (Langlois, Foss, 1996; Teece and Pisano, 1994, Dosi and Marengo, 1994; Prahalad and Hamel, 1990). As stated by NW (1982, pp128), "the behavior of firms can be explained by the routines that they employ. Knowledge of the routines is the heart of understanding behavior. Modeling the firm means modeling the routines and how they change over time".

However, as recognized by many scholars, the concept of routines has some weaknesses. As Warglien (in Cohen *et alii*, 1996) underlined, "the concept of routines is probably paying the price for its success: as it diffuses, its meaning gets increasingly vague and subject to arbitrary extensions. This is to some extent the unavoidable side-effect of popularity". Despite a well-recognized central role in the modern theories of organization, the concept of routine still reveals ambiguities, inconsistencies and lack of empirical verifications.

The purpose of the present contribution is to critically assess the role of the concept of routine in one of its principal domain of application: the competence-based approach of the firm. The main point developed in the paper is that the critical issue is to define the context in which the routines emerge. In particular the localization of routines in the organization has important consequences for our understanding of the specific dimensions of routines (cognitive, coordination and motivational), and of the structure of the firm. Routines experienced in a functional group, in a project team, in a network of partners, in a community of different nature, all different in terms of power of replication, of degree of inertia, of potential of search. We fully acknowledge that routines result from a permanent interaction between the individual and organizational levels. However, we consider that these interactions are shaped and determined at an intermediate level, the level of communities. We will emphasize the role of two types of communities: first "hierarchical communities" such as functional communities, organized hierarchically, homogeneous and sharing a disciplinary specialization (such as finance, mechanical engineers...) and second, "autonomous" communities such as epistemic communities and communities of practice, horizontally defined either by the production of new knowledge or by a common interest for a given practice. These two types of communities can be differentiated according to the way

they solve incentive problems and intra-organizational conflicts. Communities of practices and epistemic communities strongly support the cumulative process of practices and discoveries in the firm. The nature of their interactions contribute to shape the balance between exploitation and exploration mechanisms of the firm. In addition, the shaping of the architecture of the firm (the interactions between hierarchical and autonomous communities) which determines the nature of the competencies of the firm, underlines the specific role of the manager. With regards to routines, the manager acts as an internal selection mechanism that focus the managerial attention towards specific capabilities and define the "core competences" of the organization. This argumentation will lead us to an additional justification of a dual theory of the firm (Cohendet, Llerena, Marengo, 1998 and 2000, Cohendet, Llerena 1999). This type of perspectives allows us to integrate the "motivational" dimensions of routines, currently missing in the literature.

1. Routines: What has been learnt.

From the NW's book, a series of important works in the literature have thus contributed to explore the richness of the concept along the dimensions that have been exposed (Cohen *et alii*, 1996, Reynaud, 1996, Egidi, 1994; Winter, 1995; amongst others). Taking the point of view of economics, we can refer to the definition of Cohen and alii (1996, p 683): "Routine is an executable capability for repeated performance in some *context* that been *learned* by an organization in response to *selection pressures*" (Cohen and alii, 1996, p. 683). Starting from this definition, one can propose the following summing up of the main results and debates on routines in the economic literature:

** Some main results on routines*

1. Routine is a capability in the sense that routine is a capacity to generate (collective) action, to "guide or direct an unfolding action sequence, that has been stored in some localized or distributed form" (Cohen *et alii*, *ibid*, pp 683). Routines guarantee the regularity and predictability of individual behavior necessary for collective action. This property refers to the characteristic of routine as organizational memory, and expresses the cognitive and coordination dimension of the routine. As Paoli and Principe (2001) underlined, "routines embody the successful solutions to problems solved by the organization in the past. They are retrieved and executed whenever the organization faces a problem resembling one already solved". Thus, memories of the members of the organization store much of the knowledge (both tacit and articulable) needed to perform organizational routines in "repertoires" of knowledge. However, for members of the organization, the required knowledge necessary for their co-ordination is much more than knowing what is in the repertoire: "There is much more to "knowing one's job" in an organization that merely having the appropriate routines in repertoire. There is also the matter of knowing what routines to perform. For the individual member, this entails the ability to receive and interpret a stream of incoming messages from

other members and from the environment” (NW, 1982, pp 100). The routines can thus be considered as the memory about *what to do and how* (i.e. which coordinated sequences of actions to undertake)

2. As a cognitive device, routine does economize on scarce information processing, and decision-making capacity of agents (Simon, 1947, 1977; March, Olsen, 1976). Attention and other cognitive resources being scarce, routines as attention-focussing mechanisms economize on scarce cognitive resources in order to "free-up higher degrees of awareness, mental deliberation and decision making for the more complex decision" (Hodgson, 1997). As underlined by Becker (1999), "to focus attention means to reduce the space of events that managers should scan in order to avoid bad surprises and take advantage of the good ones (Shapira, 1994). This is achieved by perceiving as noise and ignoring what does not receive attention (Garud and Rappa, 1994)...Thus focussing has two sides: it has as much the meaning of "leaving something out of the window" as it does have the meaning of "being aware of something", or "drawing attention to something". This focussing process being not only spontaneous but also intentional, it open the door to a specific role of managerial capabilities (and especially to dynamic capabilities – (Teece-Pisano, 1994)).
3. Routines are essentially *context-dependent*. Execution of a routine can only be conceived in a given context that provides the natural locus of attention for collective action. The “context” includes physical state of equipment, external memories, and work environment. But as Nelson and Winter (pp105) emphasize, finally and most important, “the context of the information possessed by an individual is established by the information possessed by all other members”. Thus, the context is generative because the “creation of shared languages and shared meanings stems from the interaction of organizational members. The relationship among organizational members is quintessential for the development and consequential execution of organizational patterned activities that embody the memory of the organization. The organizational context is both prone to active individual’s mnemonic processes, and more importantly activate organizational mnemonic processes”. (Paoli, Principe, 2001).
4. As a capability, routine results and may be altered in the future by a wide variety of learning processes. Learning implies a modification of routines, even if these latter are usually hard to change, and are responsible for inflexibility and inertia in organizational behaviors (NW pp.400, Langlois and Robertson, 1995). Routines change in response to experience through two main mechanisms. The first is trial-and-error experimentation. "The likelihood that a routine will be used is increased when it is associated with success in meeting a target, decreased when it is associated with failure" (Cyert and March, 1963). The second mechanism is organizational search : " An organization draws from a pool of alternative routines, adopting better ones when they are discovered. Since the rate of discovery is a function both of the pool and of the intensity and direction of search, it depends on the history of success and failure of the organization " (Radner, 1986). According to March (1988), the importance of search is related to the hypothesis of bounded rationality: "Since only a few alternatives, consequences, and goals can be considered simultaneously, actions are determined less by choices among alternatives than by decisions with respect to search". As repeatedly argued, (Nelson and Winter, 1982 ; Dosi and Egidi, 1991, Dosi *et al.*, 1999), innovative activities involve a kind of learning quite different from Bayesian probability updating and regression estimation: it requires agents to build new representations of the

environment they operate in (and which remains largely unknown) and to develop new skills which enable them both to explore and to exploit this world of ever-expanding opportunities. Such representations are embedded in the routines which characterize the organization. Creating an appropriate environment for learning is a fundamental factor for long-term performance of business firms.

5. Various processes of selection act as filters of evolution on routines. When an existing routine is a success, replication of that success is likely to be desired, but when a routine is a failure, Nelson and Winter (pp 121) raises the question of its “contraction”. In a model of economic selection that operates on routines, many factors (the market being one selection mechanism amongst others) are involved in determining the consequences of “sustained adversity” on the persistence or change of routines. Most of the selection mechanisms mentioned by the existing literature are external to the organization, and could thus be referred to "natural selection mechanisms" finding an appropriate role in the evolutionary vision of the firm. It must also be recalled that absence of action may lead to the elimination of routine. As NW pointed, the phenomenon of memory loss (due for instance to personnel turnover) will accelerate the decay of routine.

As we mentioned in the introduction, despite these positive results, the concept of routine still reveals weaknesses and ambiguities. We will in this contribution focus on the analysis of the concept of routine when applied to the competence-based approach of the firm. We argue that the current limits of the concept have three major sources of explanation:

- 1) an insufficient examination of the motivational dimension of routine (as initially underlined by NW);
- 2) an insufficient analysis of the ways hierarchy in the organization may contribute to shape routines;
- 3) a neglected analysis of the "localisation" of routines in the organization, in particular with reference to the notion of communities.

2. Some main weaknesses in the current development of routines.

The foundations of the competence-based approach of the firm, using extensively routines as a building block of competences¹, are still fragile. Despite the abundant literature that has explored

¹ At each moment in time, a firm can be characterized by a set of productive knowledge which has been developed through a learning process and is implemented through the set of currently applied routines. Processes of selection and variation within the firm have the function to create, maintain, replicate, modify a body of distributed knowledge, which characterizes the firm. Such a set of knowledge can be called *competencies* of the firm.

The concept of competencies has recently been suggested as one of the leading explanatory variables for inter-firm diversity and its persistence and, more in general, as the main dimension along which the very nature of

many aspects of the notion of routine when applied to the theory of the firm, there are still some ambiguities and lack of in-depth analyses on some key topics. In particular, the complex path that leads from routines to competence has not been sufficiently explored. Stating that “competence is a set of routines” is not sufficient for building an unambiguous theory of the firm. To be more specific, the main weaknesses that we have chosen to pinpoint and analyze are the following:

- Recalling that NW have suggested to analyze routines along two main dimensions (the cognitive dimension and the motivational dimension), it appears that while the cognitive and coordination dimensions have been widely explored, the motivational one has been almost forgotten, with the exception of some few important contributions by Coriat and Dosi (1998) and Witt (1998).
- The application of the notion of routine to the competence-based approach is still too much inspired by a “natural selection” vision of the organization, and does not yet give enough weight to a managerial vision of the firm. More precisely, besides the external selection mechanisms that operate on routines, there is a need to clearly introduce internal selection mechanisms of routines relying on managerial decisions.
- The theoretical works on routines do insist in understanding “what is a routine”, but give little attention to the nature of the group of agents “who are involved in the routine”. In other words, the members of the organization involved in a routine are generally considered as anonymous. We consider that routines experienced in a functional group, in a project team, in a network of partners, in a community of different nature, all different in terms of power of replication, of degree of inertia, of potential of search.

the firm should be explained (Dosi and Marengo, 1994). These competencies are *coherent* sets of knowledge and capabilities to use them in an efficient way. The concept of competence, which relies on that of routines, refers to a view of the firm as a social institution, the main characteristic of which is to “know (well) how to do” certain things. Some of these competencies are strategic (“core competencies” according to Teece (1988)) and constitute the main sources of the competitiveness of a firm. They are the results of a selection process both internal and external to the firm. The management, the construction and the combination of these competencies are critical in order to understand the limits of the firm and the co-ordination as well as the incentive structure of the firm. But, and perhaps even more important, this focus on knowledge issues brings about also the issue of how such knowledge is generated, maintained, replicated, and modified (and possibly also lost), i.e. the issue of learning and its nature that have been examined above.

The recent development of the competence based approach of the firm (Pralhad and Hamel, 1990; Teece and Pisano, 1994, Dosi and Marengo, 1994) has opened some promising avenues of research for the economics of organisation. The essential characteristic of this competence-approach is that the firm is conceived as “a processor of knowledge” (Fransman, 1994; Cohendet, Llerena, 1999; Amin, Cohendet, 2000), as a locus of setting up, construction, selection, usage and development of knowledge. In fact, considering the firm as a processor of knowledge leads to the recognition that the cognitive mechanisms are essential, and that routines play a major role in keeping the internal coherence of the organisation. In other terms, the governance of the firm is not focused on the resolution of informational asymmetries but on the co-ordination of distributed pieces of knowledge and distributed learning processes. The essence of the theory relies thus now clearly on the process of creation of resources. This cognitive perspective on the study of the firm has been taken by, among others, Cyert and March (1963); Cohen, March and Olsen (1972); Cohen (1991); Loasby (1976 and 1983); Eliasson (1990); Dosi and Marengo (1994); Marengo (1996 and 1994)

This vision strongly differs from the traditional contractual approaches of the firm -transaction costs theory in particular- which consider the firm as a “processor of information”. For these traditional approaches, the behaviour of the firm can be understood as an optimal reaction to the environmental signals which are detected by the firm. The focus is thus on the process of allocation of resources needed to cope with this adaptation.

In the following sections, we propose to analyze in more details the two first weaknesses that we have pinpointed. The third constitute the basis for further developments, in the last section of the paper.

2. 1. The motivational aspects of the routines.

Nelson and Winter (1982) were the first to introduce the idea that besides the cognitive dimension, routines have a motivational dimension, and suggested considering routines "*as truces among conflicting interests*". This key statement for the building of a theory of the firm that considers that routines are governance or control mechanisms, has to date not been investigated to any great extent. Only Coriat and Dosi (1998) should be credited for clearly underlining that routines may be considered "*as being a locus of conflict, governance, and a way of codifying micro-economic incentives and constraints*"². We consider that this perspective should be widely explored. The idea that routines contain another characteristic through the implementation of mechanisms of governance and authority in the context of a collective behaviour where employees each strive towards their own interest, is indispensable to the building of the competence-based approach of the firm. The establishment of a routine within an organisation, its evolution, the testing of its problem-solving capacities, its reinforcement or its rejection, require a direct link between the notion of routine and the control and incentive mechanisms, the conflict-solving mechanisms and the sharing-mechanisms of the relational quasi-rent which govern relationships between individuals whose interests are not necessarily convergent. And, as Coriat and Dosi (1998) stress, governance feature of routines is strictly dependent on the given mode of organisation of production_: "*The set of 'Japanese' production routines does not only embody different channels of information processing but also distributes knowledge within the organisation in ways remarkably different from the Tayloristic/Chandlerian enterprise. And, at the same time, on the governance side, individuals' incentives to perform efficiently and learn are sustained (in the Japanese firm) by company-specific rank-hierarchies, delinked from functional assignments, while in the Taylorian approach, the specific mechanism of incentive governance is twofold: on the one hand the design of a new pay system (the so called 'differential piece rate system'), on the other hand, incentives had to be matched by direct visual control upon workpractices by foremen*".

In this conception, the new focus which is directed towards the mechanisms of governance comes from the fact that the creation and the distribution of knowledge appear as being inherently and principally linked to the distribution of power and of conflicts of interests. Inequalities in the distribution of information are no longer so much considered to be the origin of the mechanisms of governance, but rather the stakes which the dynamics of the creation and distribution of knowledge reveal. In this context for example, setting up incentive schemes results not so much from the need to correct asymmetries of information as from the need to control learning dynamics. In fact, the existence of shared knowledge reduces, *a priori*, the risks of moral hazard and of adverse selection as the risks of asymmetries of information become less acute. One can even put forward the hypothesis that if one considers that all agents possess cognitive capacities, the divergence of preferences may lead to other effects than those generated by the strategic use of organisational asymmetries. Cohen (1984) thus showed that diversity with regard to preferences and objectives in a

²The authors analyse this assumption by studying the archetypal forms of organisation such as Taylorism, Fordism and Ohnism.

disrupted environment where learning and the creation of competencies are the main elements for success, can be a source of increased performances. In this way, he stressed that where agents pursue objectives which are specific to their unit, and which might be contradictory, the resulting performances are more higher compared to the situation where a group of members concentrate on the same objective. Such a situation can be explained by the effects of cross fertilisation in the solution-seeking process. The collective advantage of this type of diversity is also mentioned by Loasby (1989) for whom the differences in interpretation by individuals of the same group are the origin of organisational learning. The same reasoning is to be found in Schelling (1978) in the prisoner dilemma with N number of players. Whereas the traditional principal-agent theory is explained in a static context, a dynamic approach of learning in an evolutionary perspective leads to a thorough reconsideration of the setting up of incentive schemes. But, how can one orientate learning towards desired directions while at the same time ensuring the "repatriation" of different experiences; how can diversity be stimulated while maintaining coherence; how can individuals be incited to launch a process of error-seeking, to implement new tasks and to evaluate their results and use them widely; and how can new incentive schemes be created which would make it possible to carry out, in the best conditions, processes for the creation and distribution of knowledge?

The origin of incentive schemes from an evolutionary perspective must therefore, according to us, aim to avoid, within the firm, a number of risks which are specific to a collective learning framework. Among these risks are the following³:

- the risk of a lack of incentive to improve an existing routine by "locking oneself in" a given practise without ever seeking to change. This refers to the risk of over-exploiting existing routines and causing practises to become inflexible without questioning them in the light of new experience and new information;
- the risk of a lack of incentive to explore new routines. As Nonaka (1994) stated, incentive schemes should influence an individual's commitment to create new knowledge. This commitment, which aims to avoid the risk of too great a conservatism, relies on the deep-rooted "intention" of the individual to evolve in a learning context;
- the risk of "conflicts" between individual learning and collective learning. This type of risk of a lack of incentive to combine individual and collective learning can take on many forms. Argyris and Schön (1978) noted that a major obstacle to the evolution of learning or of common knowledge stems from the gap which may exist between what individuals say ("espoused theory") and what they actually do ("theory in use", which actually controls agents' actions).

2.2. The lack of a managerial dimension.

The competence-based theory suffers also from a lack of a managerial dimension: When considering the coherence between coordination and incentive mechanisms, the incentive-based and the transaction costs approaches apparently reveal significant advantages over evolutionary ones, if we confront them to real life situations such as the relationships between shareholders and

³ this point has been developed by Cohendet P., Kern F., Mehmanpazir B., F. Munier (1998)

manager on one side, and manager and employees on the other side. It makes explicit who, in a given context, sets the incentive schemes and for which reasons; and to what extent the firm is centralised or decentralised. While in the evolutionary approach, the role of hierarchy is generally hidden by the emphasis put on routines and the influence of shareholders is not even mentioned. This emphasis constitutes a priori a strong obstacle for the integration of incentive mechanisms in the framework of the evolutionary approach.

We strongly argue at this point that, on the contrary, there is room in the evolutionary approach for a hierarchy and a managerial component⁴. Some authors (Loasby, 1991; Witt, 1998, 2000, Cohendet, Llerena, Marengo, 2000) already reappraised the role of entrepreneurs, and underlined the role of leadership as provision and enforcement frames in an evolutionary context. “The way in which these cognitive frames emerge and change over time is influenced by communication processes with the social environment which endow people with tacit knowledge, socially shared interpretation of patterns, and social models of behaviour. In many cases, e.g. within neighbourhoods or circles of friends or peers, these communication processes develop spontaneously, i.e. without being shaped by any central guidance...Sometimes however, the institutional set-up of interactions assigns certain individuals a position in which they get a chance to shape the communication processes and thus exert an influence on the collective outcome. The firm is a case in point...this fact is an important reason for why firms, as organisations, can achieve internal consistency and co-ordination of individual efforts.“ (Witt, 1998, p.7). In a way, the role of managers in an evolutionary approach is even richer than in a classical one. Beside the classical attributes of managers, the evolutionary approach allows them to shape cognitive commonalities and socially shared interpretation patterns and frames. They also influence (indirectly) the routines at all levels of the firm. They can orient the learning processes by focusing the attention on certain characteristics of these processes (by rewarding for instance exploration instead of exploitation). They play also a significant role in the selection of the core competences of the firm, through the processes of acquisition and mergers to reinforce existing core competences or by allocating resources to accumulate new competitive knowledge in a specific and given core competence. In short managers play the role of an internal selection mechanism that besides other selection mechanisms (in particular external ones such as market forces) contributes to shape the body of competences of the firm. All these attributes reinforce the assumption that managers, in an evolutionary context, do have to set up incentive mechanisms. Moreover these additional characteristics of managers strongly plead for a richer design of incentives than in the pure transactions and incentive oriented approaches⁵.

⁴ In fact the role of managerial routines (or "capabilities"), was fully recognized by Penrose (1957) in her seminal book. However, Penrose only focused on the functioning of managerial teams, without taking into account interactions at other level of the firm.

⁵ It can also be argued, but this is beyond the scope of this paper, that shareholders could find room in the evolutionary scene. In this perspective, it has to be realised that the shareholders are generally not a multitude of small shareholders interested only by the maximisation of their returns (in which case the evolutionary approach would be meaningless). The shareholders are generally, for a majority of shares, a small nucleus of rather stable companies, each of them seeking a firm which designs its core competences in such a way that they are compatible with (if not complementary to) its own core competences. In this perspective, each member of the nucleus can be considered as a specific kind of “principal“ vis à vis an “agent“-manager who is in charge of shaping the core competences of the firm.

In addition to the already mentioned mechanisms, organizational learning is also influenced by the "structure" of the organization, which "designates for each person in the organization what decisions that person makes, and the influences to which he is subject in making each of these decisions" (Simon, 1976, p.37). The organizational structure therefore contributes to define the context of any collective action within the firm: who is responsible for what, who should send what kind of information to whom, who has the authority to do so, and so on and so forth. In other words the organizational structure defines the rules of the games that individuals within an organization and parts of it (units, departments, services, and so on) repeatedly play and thus the frame within which organizational learning occurs.

What is crucial in this definition is that such rules of the games and routines should not be exogenously given but should emerge and evolve in the very process of interaction. The behavior of a firm should also depend on the structure, which, by defining the way people interact within the organization both among themselves and with the external environment, plays a crucial role in determining the outcome of the organizational decision-making process. In other words, besides the global evolutionary processes (diversity creation and selection) that faces the firm, there are similar processes taking place inside the firm to create, select, transform rules, routines and more generally the different mechanisms defining the organizational coherence of the firm⁶. Hereby again the entrepreneur/manager is too often neglected.

Thus, as Nelson stresses (1994): "A firm can be understood in terms of hierarchy of practised organisational routines, which define lower order organisational skills and how these skills are co-ordinated and higher order decision procedures for choosing what is to be done at the lower level".

3. The emergence and characteristic of routines: a community-dependent process

We consider that routines experienced in a functional group, in a project team, in a network of partners, in a community of different nature, are all different in terms of power of replication, of degree of inertia, of potential of search.

Our main point will be to consider that the context in which the routines emerge matter. The "organizational" and knowledge environment has important consequences for our understanding of how routines work, on their three dimensions: cognition, coordination and motivation, and how they structure the firm. As a consequence of both *context-dependance and capability design*

⁶ Coherence refers to the co-ordination of distributed pieces of knowledge and involves the creation of commonly shared bodies of knowledge: sets of facts, notions, "models of the world", organizational routines, rules, procedures which are – at least partly – known to all the members of the organization involved in a given interaction. In a sense this kind of co-ordination is a pre-condition for the co-ordination of actions which is examined by most current literature and which implicitly assumes that all these mechanisms for the co-ordination of dispersed knowledge are already in place. It seems in any case most unlikely that mere incentive mechanisms could alone be sufficient to promote this kind of co-ordination.

of routines, the localisation of the routines in the organisation is essential. The nature of the activities concerned (production, research development, finance ...), the goals and motivations of the potential users and developers of the routines, ...contribute to shape the speed and the inflexibilities and the different dimensions of the emerging and used routines.

More precisely, we want to advocate for an intermediate level. We acknowledge the role of a permanent interaction between the individual and the organization one in the design process of the routines. However, we consider that these interactions are shaped and determined at an intermediate level: the level of "communities".

Our focus will be on two specific types of communities: first, "hierarchical" communities such as functional communities, organized hierarchically, homogeneous and sharing a disciplinary specialization (such as finance, mechanical engineers...) and second, "autonomous" communities such as epistemic communities and communities of practice, horizontally defined either by the production of new knowledge or by a common interest for a given practice.

3.1. Some definitions about communities⁷

When considering the communities, it appears that some of them are rather knowledge creation oriented and some other are action oriented; some are defined and controlled by specific hierarchical mechanisms, others are more autonomous. To clarify the distinctions between communities, we present the best identified form of communities existing within a firm, namely functional groups and two newer concepts, epistemic communities and communities of practice.

Functional groups

Functional groups are traditional communities characterised by homogeneous agents sharing a disciplinary specialisation (such as marketing, finance, accounting, etc...). These communities are the basis of the division of work. They play the key role in the functional structures of the firm as described by Chandler (1977). They are also present both in divisional structures and matrix structures of the firm. In this type of community, the production of knowledge within the firm is unintended. The original knowledge is defined in the codebooks of the respective disciplines, and agents communicate with one another with codes and local jargons developed in their own discipline. The dominant learning mode is learning by doing, and the recruitment procedure is based on the recognition of the mastering of the discipline (diploma) by the hierarchy of the firm. They are dominated by a vertical relationship to the hierarchy.

Epistemic communities and communities of practice are the most relevant types of groups in the case of a firm considered as a knowledge processor (Fransman, 1994), since they are the place where the knowledge creation is likely to occur. The key point to distinguish them, is that epistemic communities are truly oriented toward new knowledge creation, whereas communities of practice are oriented toward the achievement of an activity. In this latter case, knowledge creation is an unintended spill-over.

⁷ See Cohendet, Creplet, Dupouët (2000) for a more extended development of the arguments.

Epistemic Communities

Epistemic communities can be defined as small groups of “agents working on a commonly acknowledged subset of knowledge issues and who at the very least accept a commonly understood procedural authority as essential to the success of their knowledge activities” (Cowan *et al.*, 1998). Epistemic communities can thus be defined as a group of agents sharing a common goal of knowledge creation and a common framework allowing the shared understanding of this trend. The goal of epistemic communities is thus simultaneously outside and above the community’s members.

What defines a community is thus the existence of a procedural authority that can be explicit or not. However, it must be different from the kind of authority held by a “guru” to ensure a certain autonomy of the members. Moreover, the procedural authority conveys the idea of progress toward the cognitive goal set by the community. The belonging of members will thus be evaluated with respect to this procedural authority. It should be noted that this procedural authority can *a priori* emerge from the interactions among members. In that case, the organisational closure is either realised, or imposed from the outside and then not realised. In the former case, the epistemic community is self-organised and then close in this respect to a community of practice. This remark is important since it shows evidence of the possibility for one form of community to evolve into the other.

Epistemic communities are structured around a goal to be reached and a procedural authority endowed by themselves (or with which they were endowed) to fulfil that goal. Notions of autonomy and identity are thus weaker than in the case of communities of practice (see below), thus favouring the group’s creativity (Kao, 1998; Leonard-Barton, 1995). Thus, the community increases its ability to seize future opportunities.

Because of the heterogeneity of the agents, the objective of knowledge creation for the sake of knowledge, the first task of epistemic communities is to create a “codebook”. Hence, knowledge circulating within epistemic communities is explicit (but not codified since it remains mainly internal to the community). Validation of the cognitive activity of an agent is made with respect to the procedural authority. What is evaluated is the contribution to the endeavour toward the goal to be reached, according to the criteria set within the procedural authority. Within an epistemic community, agents are bound together by their commitment to enhance a particular set of knowledge. The recruitment rule is thus defined with regard to the contribution an agent makes to fulfil this goal.

Communities of Practice

The concept of *communities of practice* was introduced by Lave and Wenger (1990) who, by focusing on individuals' practices, identified groups of persons engaged in the same practice, communicating regularly with one another about their activities. Members of a community of practice essentially seek to develop their competencies in the practice considered. Communities of practice can then be seen as a means to enhance individual competencies, they are oriented toward their members (Lave and Wenger, 1990; Brown and Duguid, 1991). This goal is reached through the construction, the exchange and the sharing of a common repertoire of resources (Wenger, 1998). Wenger (1998) and Brown and Duguid (1991; 1998) state that self-organisation is an essential characteristic of communities of practice⁸. More precisely, autonomy and identity

⁸ According to Lesourne (1991), self-organisation is the ability of a system to acquire new properties by organising itself or by modifying by itself its own organisation (Lesourne, 1991). Self-organisation confers to the system an

of communities, the key characteristics of self-organisation allow the collective acquisition and processing of stimuli from the environment (Wenger, 1998; Dibiaggio, 1998). Identity and autonomy are essential for the agent to define him-/herself with respect to his/her environment and for the members of the community to behave collectively.

The self-consciousness is also visible in the mutual commitment of the community. It is built around activities commonly understood and continually renegotiated by its members. A community's member feeds it with his/her experience and, in turn, relies on the knowledge capitalised by the community to carry out his/her activity. They develop a jargon understandable by the members only. It is thus a mutual commitment that binds agents in a social entity, ensure cohesion of the community and recruitment of new members.

Lave and Wenger (1991) interpret the practice of these communities as the vector of learning, that is in turn the building of an individual entity. Hence, the evaluation of an individual is made by the community of practice as a system and is focused both on the values adopted by the individual and on the progress made in his/her practice, the two being co-constitutive.

Within communities of practice, the privileged knowledge is thus essentially the know-how (Brown and Duguid, 1991), which is tacit and socially localised. The nature of knowledge is due to the objective and the structure of the communities of practice. As a result, the community tends to send no messages toward the outer world. Messages are almost exclusively exchanged among the members of such a community.

3.2. Distinctive features of communities according to the creation of knowledge, the coordination mechanisms and the incentive structure.

It is possible to characterise the contribution of the different communities to the nature of routines existing in a firm. Each communities has his own process of creation of routines and each of them have cognitive, coordination and incentive characteristics and are ambivalent in this respect.

Table 1 summarizes some of these characteristics.

Table 1 : A typology of some communities within the firm
(abstract from Cohendet, Creplet, Dupouët, 2000).

	Objective	Agents	Cognitive Activity	Recruitment rule	Knowledge Production and Dominant Learning	What holds the Community together

adaptive ability to evolve without any constraint of authority nor any determinism. The system is then autonomous and sets a boundary with respect to the other functions of the firm. It creates a sort of "organisational closure" in the terminology of the theory of self-organisation. This idea is important since it underlines the cross functional nature of communities of practice within the firm.

					Mode	
Functional Group	Ensure a given function	Homogeneous	Disciplinary Specialisation	Hierarchical	Unintended Learning by doing	Education Task definition
Community of Practices	Increase the skills in a given practice	Homogeneous	Accumulate knowledge about a given practice Circulation of best practices	Members who select themselves	Unintended Learning in working	Common passion for the practice
Epistemic Community	Produce knowledge	Heterogeneous	Construction of knowledge or language or messages Circulation of codified knowledge	By peers	Intended Searching	Respect of a procedural authority

Concerning the cognitive processes, each communities have different learning processes, except for the epistemic one, there are usually un-intended. It means in particular, that the routines developed are essentially oriented towards coordination mechanisms or incentives, learning appears, and can even be important, but only as a by-product of the "main" objective: to be a specialist, or an efficient professional. For epistemic communities, on the contrary, all the characteristics contribute to the creation of knowledge: the diversity of members, the recruitment and recognition by peers, and the existence of a "procedural authority".

In the case of incentive mechanisms , it seems interesting to introduce a distinction between extrinsic incentive (adapted to the situations described by the theory of the agency) on the one hand and intrinsic motivation on the other (Kreps, 1997). The distinction relies on the intuition that some tasks, especially for tasks undertaken by epistemic communities, cannot abide by standard incentive constraints. More generally those are the tasks for which creativity and quality are essential dimensions. They are moreover multi-faceted tasks of which the more important aspects are difficult to measure. In such situations, it may be difficult to work out the proper incentives (Kreps, 1997, p.361). More precisely :

- either one considers that there are actual intrinsic motivations, such as some pride in carrying out one's work as in the case of academic research and there is no "disutility of effort", on the contrary. In this case extrinsic incentives should be as light as possible for they are not necessary and could be counter-productive;
- or one considers that intrinsic motivations are actually vague extrinsic incentives (e.g. colleagues' respect) and incentive mechanisms to be implemented must remain vague. In such a context of limited rationality where it is impossible to foresee everything, the use of rather vague evaluation criteria *ex ante* makes it often easier to mobilise agents than criteria resting on rigid and precise formulas (Kreps, 1997, p.361).

On one side, according to this classification, functional groups would develop rather extrinsic incentives schemes and on the other, epistemic communities and communities of practices would have the tendency to adopt intrinsic motivations: the proud to do "go work" or to be recognized as

"a peer among the peers". The functional group will have a principal/agent type of incentive structure. In communities of practices, the "best practices" implies both financial rewards and mutual recognition by the "profession". And in epistemic communities, the endogeneous evaluation process induces the recognition by the procedural authority, and finally ends by the mere involvement to the procedural authority itself.

The coordination mechanisms are directly linked to the internal organisations of these communities: the functional one, being vertically structured and coordinated; the two others are horizontally coordinated: among homogeneous practitioners in the former case; among peers in the later.

But, once the mere fact of a diversity of communities is accepted then new questions emerge:, like:

what can be said:

- about the "compatibility" of the rules and routines emerging in those communities ?
- about the "coherence" of the communities, in terms of achieving the general goal of the firm, in addition or in opposition to the specific goal of the communities;
- about the frontier of the firm, knowing that communities such that the communities of practice and the epistemic ones cross very often the boundaries of the existing firms ?

Even if much of those questions are questions for further research, we can already indicate some main properties and features of the organisation of the firm resulting from the views presented in this paper.

Considering the "compatibility" and the "coherence" aspects, we should keep in mind that if a routine usually ensures a main function, whether the routine deals mainly with activating a learning process, preventing an opportunistic behaviour or coordinating individual actions, it entails at the same time implications regarding the two other functions in addition to the main one. Any routine supports as well side (or related) functions. In other words any routine must be considered *a priori* as ambivalent, i.e. as a vehicle of several functions (Llerena, Matt, Wolff, 1999; Llerena and alii, forthcoming). It results that the performance of the organisation will depend as well from the existing balance between different communities and from the compatibility and coherence of the set of rules and routines mobilised by them. As to the "frontier of the firm" question, our approach leads naturally to a "dual" theory of the firm (Cohendet, Llerena, 1999).

We have then a representation of the organisation of the firm composed by:

- *Entrepreneurial capabilities encapsulated in the managerial level of the firm*⁹.

This capabilities is at the source of the control and monitoring activities in the firm. Within this evolutionary perspective, we can now try to define more precisely the content that should characterize this entrepreneurial function.

⁹ see Cohendet, Llerena, Marengo, 2000

- First, the entrepreneurial function has to be characterized by a specific “ asset ”: its “ dynamic capabilities ”, i.e. the ability to manage strategically the adaptation, the integration and the re-configuration of internal and external organizational skills, resources and functional competences towards changing environment; where time to market and timing is critical, the pace of innovation is accelerating, and the nature of future competition and markets is difficult to determine (Teece, Pisano, 1994, p. 538). This capabilities means that in particular the entrepreneur has a representation of not only the possible evolution of his external environment but also of the corresponding internal configuration, which is relevant for the meeting the requirements of the external environment. In other words, the key entrepreneurial function in an evolutionary approach is to organize the matching process between internal and external environment.
- Secondly, to act as an active interface between the internal and external environments of the firm, the entrepreneur has to develop and diffuse a specific “ vision ” of the firm’s context and future. The vision of a firm is defined as the dominant set of beliefs in the firm regarding the firm’s internal and external circumstances, the shape of things to come in the future, and, in the light of these factors, the way the firm should “ play its cards ”. Since vision depends on the particular construction of particular beliefs, vision is by definition always bounded. Bounded vision and the possibility of vision failure are, therefore, logical implications of the concept of vision. (Fransman, 1994). It is in accordance to this vision that the entrepreneur will position the firm in its environment, defining both its strategy and its internal structure. It should be emphasised that by an active position towards the external environment, we mean that the entrepreneur is able to influence the competitive context in which he evolves. Innovations of different nature will allow him to determine at least partially the selection mechanisms at work outside the firm. In fact, he might endogenize the external environment, and build a flexibility of initiative (Amendola, Bruno, 1990). This capacity of shaping the external environment is also a way to influence the nature of the industry evolution. Expectations and visions are of major importance for the understanding not only the evolution of firms, but also the evolution of industries.
- Thirdly, the vision or the business conception, which is a primary entrepreneurial input (Witt, 1998, p.162) will impact the organization of the firm itself. In fact, we even strongly argue at this point that there is, in this respect, a room in the evolutionary approach for a hierarchy and a managerial component. Some authors (Loasby, 1991; Witt, 1998) already reappraised the role of entrepreneurs, and underlined the role of leadership as provision and enforcement frames in an evolutionary context. “Cognitive commonalities, that is, socially shared tacit knowledge including knowledge about social models of behavior, may emerge spontaneously from intense communication as an unintended collective outcome and may, as such, be difficult to influence. Sometimes, however, the institutional set-up of the interactions assigns certain individuals a position in which they get a chance to shape the communication processes and thus to exert an influence on the collective outcome. The firm organization is a case in point. Indeed, the social-cognitive implications of bounded rationality are the key to the understanding why firms, as organizations, are able to achieve internal consistency and co-ordination of individual efforts.“ (Witt, 1998, p.166).

- *The three types of communities*

Each communities having its own mechanisms of emergence of routines. The cognition, coordination and incentive being specific, with different properties in terms of knowledge production and allocation, the main task of the managerial area will be to define the relevant trade-offs according to the external selection mechanisms to which the firm is exposed: nature of the competition, specificities of the technology and products, etc. It is here that the risks mentioned in paragraph 2.1. get their real dimension... incorporating the "inter-communities" aspects.

All routines, independently from their origin, contribute to the cumulative process of knowledge creation and of allocation, to the searching processes, to the building of core competences, mais in different ways:

- epistemic communities are leading actors in the searching activities. They have an important capacity to replicate the relevant routines, to evaluate the new experiments, to capitalize them, creating new knowledge blocks. The hierarchies can try to monitor and control them at least but keeping some degree of freedom... to leave them with some dynamic flexibility...
- communities of practices embed an important potential for the exploitation of existing routines, of increasing their efficiency, by exploiting the best practices. There is in this case a strong tendency for hierarchy to control these routines and to capture them, in particular their replication. One process to do so is to develop the codification process of the relevant know-how.
- functional groups can then be viewed as the operators of the manager and the hierarchies to crystallize the know how into codified rules and procedures.

The balance between the different groups and communities will definitively shape the behaviour of the firm in terms of exploration and exploitation, i.e. the nature of its comparative advantages, and in fine its performance. The development of project teams (hierarchical by definition, with a "project leader") is a good example of an organizational tool which tries to create "hybrids" of the different communities. The objective is to create some specific "quasi-communities" with respect in particular to incentives. The main remaining problem is certainly the capability to repatriate the knowledge created during the project in the existing communities and in the following projects. In other terms, there is an open question about the cumulativeness of such organization, i.e. the codification of new knowledge and the replication of the new routines.

In addition, the performance of the firm implies that the architecture of communities (and in fact of routines) includes, in each communities capacities of mutual communication and absorption of knowledge.

Finally, as it will be discussed in the next section, the mere fact that the focus of attention is the key limiting factor, implies that only a sub-set of communities will be integrated at the core of the firm... or even in the firm. It means in particular a selection, which induces de facto loss of degree of flexibility (in particular in the static sense). In fact, the "entrepreneur" has in this dimension to find the relevant trade-off between the gain from dynamic flexibilities (through an investment in exploration activities in epistemic communities) and the loss of static flexibility (through the selection of a short list of core competences).

4. Concluding remarks: towards a dual theory of the firm¹⁰

As Coriat and Weinstein (1995) pointed out, the evolutionary approach of the firm offers a unique advantage, compared to other competing theories, to provide explanation for three key issues of importance to understand the theoretical foundations of firms:

- It explains how one can define a firm: through the set of competences that the firm encompasses;
- It explains why firms differ: because they rely on different routines and competences that are specific and that cannot be transferred (at low cost);
- It explains the dynamics of firms: through the combined mechanisms of selection and variation on the body of existing routines as the possibility of transforming a set of secondary routines into a new core competence.

Another key feature of the evolutionary theory of the firm is that it proposes an in-depth reconsideration of the governance mechanisms. According to Williamson's conception, governance mechanisms are intrinsically linked to the information processing nature of the firm: transaction costs are a kind of information processing costs, and governance structures are so designed as to minimise such costs. As Milgrom and Roberts (1988) suggest: "The incentive based transaction cost theory has been made to carry too much of the weight of explanation in the theory of organisations. We expect competing and complementary theories to emerge - theories that are founded on economising on bounded rationality and pay more attention to changing technology and to evolutionary considerations". What the evolutionary theory proposes is more ambitious: it is the setting up of governance mechanisms based on the need for co-ordinating distributed knowledge and distributed learning processes. Mechanisms of governance relative to the distribution of knowledge come within a world of resource creation, where inadequate attitudes towards the creation or diffusion of knowledge (insufficient exploratory mechanisms for instance) are the main problem to overcome.

However, the evolutionary theory of the firm has still very little to say on resolution of conflicts within the firms and most of all on the potential conflicts that could emerge between shareholders and managers. It has also very little to say up to now on the role of the entrepreneur in an evolutionary context. These issues leave a number of areas of research open, but significant progress can be expected in the near future and we are confident that the evolutionary theory of the firm will constitute soon a coherent body of knowledge for the economic theory as a whole.

Evolutionary approaches on the contrary emphasise that in a world where agents differ in their perceptions of the environment, and where communication, acquisition of information and computation are limited and costly, co-ordination can only be achieved by means of the definition of a common set of rules, codes and languages which are well understood and shared by all the members of the organisation involved in a certain interaction. Routines, rules, procedures, standards, etc. become then central in the conceptual framework, and also incentive schemes and information sharing rules have to be analysed devices for the co-ordination of distributed pieces of knowledge and distributed learning processes.

¹⁰ see in particular Amin, Cohendet (2000), p. 100

In line with the above development, the consideration of knowledge management conceived as a strategic necessity for the firm, on which are based the long term competitive capabilities, implies significant consequences.

In our view the core statement of the modern theory of the firm is that the firm must be *seen in primes* as a processor of knowledge, and not just as a mere information processing device. To be more specific, in a context in which the focus of attention is the key limiting factor, the firm will focus its limited attention on its core competences. Within this set of core competences, the firm functions as a knowledge processor giving full priority to the creation of resources. Such a focus signifies that the activities that belong to the « core » of the firm are not considered as being tradable on a market: they are « disconnected » from any « make or buy » trade-off as suggested by the transaction cost theory. However the scope of the set of core competences is very limited, for managing core competences is by definition very costly: it requires specific sunk costs, forging and managing alliances and other types of cooperation with those institutions who have the complementary forms of knowledge, accessing and absorbing the most recent scientific results related to the domain of core competences, etc... That is the reason why, companies they generally chose some few core competences to develop, extend and protect in the long run.

Once the set of activities that belong to the core competences has been chosen, the other activities that do not belong to the core (the « periphery » or « non core activities ») are then managed under traditional methods which may rely on the transaction cost approach. These activities are necessary to support core activities, and they generally correspond to the larger number of activities and employment positions in the firm. These activities do not require by definition a strong commitment in terms of knowledge management. The firm just needs to « be informed » of the best practices of external firms and organisations that can offer equivalent support services and if it appears that these activities are too costly to be run within the firm compared to market mechanisms (according to transaction costs criteria), they will be outsourced.

The consequence of this « lexicographic » choice (firstly the focus on core activities, then managing the periphery) is that the firm needs to define two distinct structures of governance to manage the different domains: a first structure of governance to manage core competences in order to align dispersed knowledge and expectations, and a second structure of governance conceived along the transaction costs criteria to manage the periphery.

The first structure of governance will be designed to orient the learning processes that are critical for strengthening the core competences of the organisation (in order for instance to avoid conflicts and incoherence between individual and collective processes). Within this « core » structure, some contractual schemes may naturally be implemented (stock options, or specific rewards for inventors within the organisation, for instance), but they are not essential when compared with the priority given to the stimulation of collective learning processes.

In the second structure of governance, classical contractual schemes are dominant to ensure the information processing that is central to the functioning of the periphery.

The possibility of a dual structure arising within the same firm raises problem of internal coherence. The tensions within a firm that is at the same time trying to organise and manage its information flow and its knowledge base has been for instance analysed by Marengo (1994) when discussing the limits of the well known multidivisional (M-form ») and functional (« U-form »)

forms. He noted that these traditional forms are conceived to solve information problems (information overload by managers, in particular) and that they are not appropriate for creating knowledge. He argues, for example, in the case of the U-form,

" It can be argued that the U-form centralizes competences in inter-functional coordination and decentralizes instead to functional departments competences in many strategic issues concerning products and diversification. With the growing multiplicity of products the functional structure does not seem that of information overload, but that of mismatch between competences and tasks. Chief executives are unable to do their job effectively, not because they are burdened by excess information, but rather because the organizational structure does not enable them to develop the necessary competences. Chief executive should respond to environmental changes, but when such changes push towards product diversification, many of the competences that are necessary to promote and manage diversity remain, in the U-form, at the level of functional departments" (Marengo, 1994).

In fact, in the classical cases of M and U-forms, the priority was given to the information processing and not to the knowledge processing of the firm, that is to the process of allocation of resources and not to the process of creation of resources. What is assumed in a dynamic perspective centered around the focus on core competences is precisely the reverse hypothesis: a priority given to the process of knowledge creation, and then, bounded by this priority, the definition of the mechanisms of allocation of resources. This however raises in a renewed way the problem of the internal coherence of the firm¹¹.

¹¹ see Cohendet, Llerena, Marengo, 1998

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