
Evolutionary and competence-based theories of the firm

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Geoffrey M. Hodgson

*The Judge Institute of Management Studies, University of Cambridge,
Cambridge, UK*

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This essay explores evolutionary and competence-based theories of the firm. “Evolutionary” approaches to the theory of the firm often invoke the biological metaphor of natural selection[1]. The classic example here is the seminal work by Richard Nelson and Sidney Winter: *An Evolutionary Theory of Economic Change* (1982). Exponents of evolutionary approaches argue that they provide better theoretical tools to understand technological and organizational change within the firm, especially when compared to the more static, equilibrium-oriented approaches of neoclassical economic theory[2].

Evolutionary theories can be regarded as a subset of a wider class of theories, variously described as “capabilities”, “resource-based”, or “competence-based” theories of the firm. We shall use the latter term here, although the other terms are common in the literature[3]. The competence-based perspective sees the existence, structure and boundaries of the firm as explained in some way by the associated existence of individual or team competences – such as skills and tacit knowledge – which are in some way fostered and maintained by that organization. Early precursors to this view include Adam Smith and Karl Marx, who saw the division and management of labour as crucial to the developments of skills and providing a key rationale for the firm. But there is a variety of twentieth-century exponents, notably including Frank Knight (1921), Edith Penrose (1959), George Richardson (1972), as well as Richard Nelson and Sidney Winter (1982). The central idea of competences provides the basis for evolutionary and non-equilibrium theories of industrial competition and development. Within this group there is a diversity of views, particularly over the nature of (tacit) knowledge, the units and methodology of analysis, and the application of the evolutionary analogy (see Chandler, 1990; Kogut, 1991; Lazonick, 1990; Nelson, 1991; Pavitt, 1988; Witt, forthcoming.) Nevertheless, the competences paradigm has attracted a wide and growing following and its ideas are now prominent in the literature on corporate strategy (Pettigrew and Whipp, 1991; Prahalad and Hamel, 1990; Wernerfelt, 1984; Winter, 1987). Furthermore, the competence-based approach has links with similar approaches in a number of allied areas, including technology studies and international business (Cantwell, 1989; Dosi *et al.*, 1988; Dosi *et al.*, 1990; Rosenberg, 1994).

The competence-based or competence perspective contrasts with the other large set of theories, frequently described as contractual or contractarian theories of the firm. The focus there is not on the developing resources and

skills within the firm but on explicit and implicit contracts between employers, employees and other contractors. The contractual approach emanates from the work of Ronald Coase (1937) and emphasizes the cost of making and monitoring transactions. But even within itself it includes contrasting theories. On the one hand, for instance, there is Oliver Williamson (1975, 1985) who clearly emphasizes the distinction between markets and hierarchies. On the other are Armen Alchian and Harold Demsetz (1972)[4] and “nexus of contracts” theorists such as Eugene Fama (1980) who enforce no such distinction but see monitoring or metering costs as crucial. Another influential contractarian approach to the theory of the firm, centring on a formal analysis of incomplete contracting and the principal-agent problem, has been developed by Oliver Hart, and his associates Sanford Grossman and John Moore (Grossman and Hart, 1983, 1986; Hart, 1985, 1988, 1995; Hart and Moore, 1990). Despite their differences, all these exponents see the informational and other difficulties in formulating, monitoring and policing contracts as the crucial explanatory elements. In particular, work in the Coase-Williamson tradition is described as “transaction cost” economics, because of its emphasis on the costs of formulating, enforcing and monitoring contracts.

A primary distinction in theoretical analyses of the firm is thus between “contractual” and “competence” perspectives, with “transaction cost” theories as a subset of the former and “evolutionary” approaches as a subset of the latter. It should be noted, however, that while “contractual” and “competence” perspectives are quite different in character, several writers try to incorporate both approaches in their work. Indeed, the plausibility of hybrid explanations may stem from the complex nature of economic reality and the fact that a number of causal mechanisms are simultaneously at work. As long as they do not involve internal inconsistencies, plural rather than singular explanations may, in principle, be possible and plausible. An example of a plural position is the work of Richard Langlois (Langlois, 1992; Langlois and Robertson, 1995). Similarly, David Teece and Gary Pisano (1994) place emphasis on human learning and the enhancement of competences or “dynamic capabilities” while paying some recognition to the role of transaction costs. They argue that the firm arises “not only because of transaction costs ... but also because there are many types of arrangements where injecting high powered (market-like) incentives might well be destructive of the cooperative activity and learning” (p. 539). The relationship between evolutionary, competence-based, contractarian and transaction cost theories is illustrated in Figure 1.

Despite efforts by some theorists to unify contractarian and competence-based approaches, some of the impetus behind the development of competence-based theories stems from dissatisfaction with exclusively transaction cost explanations or with the logic of transaction cost arguments. At first some problems with the contractarian approach are raised. This provides the point of departure for a discussion of the competence-based alternative. Its evolutionary variants are examined subsequently. The essay concludes with a discussion of the relevance for the theory of corporate strategy.

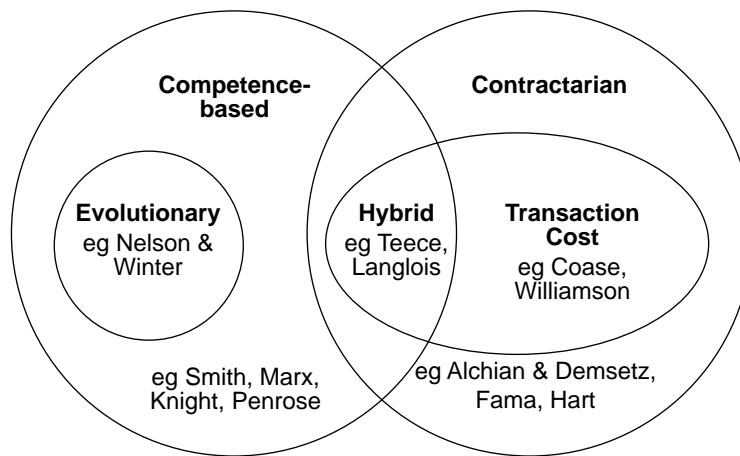


Figure 1.
Relationships between
types of contractarian
and competence-based
theory

Problems with contractarian approaches

Three key features of existing contractarian approaches are identified here, and later contrasted with aspects of the competence-based analysis of the firm. The three features are:

- (1) Given individuals – typically with given and independent preference functions – are assumed. Transactions between these social atoms are identified as the basic starting points of analysis and it is assumed that all such transactions are evaluated by individuals in terms of uni-dimensional utility levels. Typically, this leads to a neglect of (a) the limits of contracts and exchange and the necessity of non-contractual relations, particularly loyalty and trust, and (b) processes of radical individual transformation and development, notably an adequate concept of learning. The individualistic focus similarly excludes notions such as organizational learning and group knowledge, leading to an associated neglect of the types of skill and knowledge associated with teams.
- (2) The analysis of the firm is reduced to contracts between individuals, often involving the minimization of transaction costs, but typically neglecting technology and production in the following manner. The characteristic assumption of a uniformity of technology over different governance modes implies a separability of production and technology from governance structures or transaction costs. Accordingly, the explanatory contribution of production costs and technology is ignored while governance modes are evaluated. As a result, the emphasis is not on production, accumulation and growth but on the choice of governance structures and the efficient allocation of given resources.
- (3) A focus on comparative static explanations, where one organizational arrangement is deemed to have lower (transaction) costs than another,

leads to inadequate treatment or neglect of dynamic aspects of the problem, notably learning, innovation and technological development. Furthermore, the focus becomes one of static, cost-minimizing efficiency, rather than dynamic efficiency and long-term advantage. Comparative-static or equilibrium-based explanations also have difficulties accounting for the manifest heterogeneity of firm behaviour and performance in the real world.

We now consider these three points in more detail.

Given, atomistic individuals

Arguably, with the contractarian approaches – including the “new” institutional economics of Williamson and others – we have no more than half of the story about institutions in general and firms in particular. The focus is on how given, cost-minimizing or utility-maximizing individuals relate to each other to form and sustain institutions. The possibility of individual preference functions themselves being moulded by culture and institutions is ignored. The individuals themselves remain impenetrable atoms: they are not affected fundamentally by institutions and culture. As Roderick Martin (1993, p. 1,096) observes, paradoxically “the new institutional economics does not take institutions seriously enough: organization is reduced to the status of a means of regulating relationships in default of market relations”.

Transaction cost and other contractarian analyses reduce the interaction between individuals to the calculus of costs. Individuals act as utility-maximizing automata on the basis of given preferences. Not only do preferences arise mysteriously from within the individual; social institutions bear upon individuals simply via the costs they impose. As Mary Douglas (1990, p. 102) points out in an article critical of Williamson:

He has a theory of firms, but his theory of the relationship between individuals and firms could be better. He believes firms vary, but not individuals. He has the same representative rational individual marching into one kind of contract or refusing to renew it and entering another kind for the same set of reasons, namely, the cost of transactions in a given economic environment.

On the basis of the assumption of given individuals, contractarian approaches extend concepts that pertain primarily to a market environment into a quite different sphere. In his classic critique of the contractarian tradition in social science, Emile Durkheim insists on the existence, necessity and irreducibility of non-contractual elements in all social relationships, even within the sphere of markets and exchange. He points out that while in general an explicit agreement is necessary for any valid contract, there are elements involved that cannot be reduced to the expressed intent of any individual: “For in a contract not everything is contractual” (Durkheim, 1984, p. 158). Whenever a contract exists there are factors, not reducible to the intentions or agreements of individuals, that have regulatory and binding functions for the contract itself. His key argument is that for all contracts there exists a set of binding rules to

which there is no explicit or detailed reference by the parties involved. All market-based and contractual systems thus rely on essentially non-contractual elements – such as trust and moral norms – to function.

This strikes at the core of contractarian theories of the firm where non-contractual relations such as trust and loyalty are neglected. Just as seriously, the conception of the given individual cannot readily incorporate notions such as learning and personal development. Instead of a mechanism by which one individual with given aims and preferences directs another, management becomes a process of learning and discovery in which new aims appear. As Brian Loasby (1995, p. 472) puts it:

It is typically assumed that the best action in any situation is known to the agent who is expected to act, and that the problem is to ensure, if possible, that this is indeed the action that the agent will take; but the primary task of managers is to discover, or (more often) to encourage other people to discover, what action is best, after first identifying what problems or opportunities should receive attention; and it is a major objective of good organization to facilitate this process of identification and discovery.

Instead of the mere input of “facts”, learning is a developmental and reconstitutive process. Typically, neoclassical economics treats learning as the cumulative discovery of pre-existing “blueprint” information, or Bayesian updating of subjective probability estimates in the light of incoming data (Bray and Kreps, 1987). There are severe problems, however. For instance, as John Hey (1981) demonstrates, a process of Bayesian learning in search of an optimum depends on the assumption of correct prior knowledge. Accordingly such search models may break down if such an assumption does not apply. Furthermore, as Giovanni Dosi (1988), Giovanni Dosi and Massimo Egidi (1991), Richard Nelson (1980) and others have argued, the Bayesian approach is a very limited way of conceiving of the role of learning, which in reality is much more than a process of blueprint discovery or statistical correction.

In standard contractual analyses, agents act as if they shared the same model of the world. There may be problems of imperfect information but generally these do not emanate from interpretative ambiguity and differences of perception or cognition. Instead, obstacles to efficient coordination within the firm are typically founded on presumed clashes of individuals’ goals and interests, as evidenced by Williamson’s persistent emphasis on individual opportunism (Kogut and Zander, 1992). Given such assumptions, attention is directed at the lack of a complete sharing of (unambiguous) information or at allegedly inappropriate incentive structures. This “positivist” stance fails to acknowledge that for information to become knowledge it must be interpreted, and different interpretations are always possible, even with the same set of information (Fransman, 1994; Hodgson, 1988; Nooteboom, 1992, 1995). In standard contractarian explanations, key obstacles to efficiency are not located in the existence of dissimilar cognitive frameworks or different ways of seeing and understanding. This is a serious omission.

Learning depends on acquired cognitive frameworks but at the same time it is an essentially open-ended, provisional and potentially fallible process. It is

not simply the progressive acquisition of unambiguous or codifiable knowledge. As well as the possibility of interpretative ambiguity, much knowledge is tacit (Polanyi, 1967) and has to be communicated by example and shared experience rather than by the written or spoken word. Furthermore, learning is a process of problem-formulation and problem-solving, rather than the acquisition and accumulation of given "bits" of information "out there". This process involves conjecture and error, in which mistakes become opportunities to learn rather than mere random perturbations (Berkson and Wettersten, 1984; Popper, 1972; Rutherford, 1988).

In general, and acutely within organizations, learning involves the alteration of cognitive frames and mental models of the world (Argyris and Schön, 1978; Cohen and Sproull, 1996; Senge, 1990; Tomer, 1987). Accordingly, learning often involves the rejection of inadequate ways of seeing and doing. Learning is not the cumulative addition of knowledge on a *tabula rasa*: it involves destruction as well as construction. Developing the capacity to unlearn, and learn anew, is itself a part of the learning process. As Kate Cartier (1994, p. 190) puts it: "The idea that knowledge is accumulated (as in the work of Arrow and others) is at variance with with the theory that it is continuously reformulated". Furthermore, problems do not themselves provide nor necessarily suggest solutions: much learning must involve intuition and creativity.

According to Argyris and Schön (1978) and others, learning is not simply information absorption. Learning begins when individuals discover that their mental models, which indicate the expected consequences of particular actions under a variety of assumed conditions, are in error. Because of discrepancies between actual and expected outcomes, people may revise their models, that is, they learn. Organizational learning involves a process of inquiry, reflection and evaluation in which the model is revised and becomes embedded in organizational memory and the regular practices of the organization (Cohen and Sproull, 1996).

There are further reasons why an enriched conception of learning is not found in the equilibrium analysis of neoclassical economics. Neoclassical economics assumes rational agents, yet it is not obvious what is meant by "rational learning". How can agents be said to be rational at any given moment when they are in the process of learning? The very act of learning means that not all information is possessed and global rationality is ruled out. Learning is more than the acquisition of information, it is the development of the modes and means of calculation and assessment. If the methods and criteria of "optimization" are themselves being learned, how can learning itself be optimal? By its nature, learning means creativity and the potential disruption of equilibrium. In short, the phenomenon of learning is antagonistic to the concepts of rational optimization and equilibrium.

A strange paradox exists in neoclassical economics, especially since Lionel Robbins (1932) insisted that the subject must be defined in terms of scarcity and choice. On the one hand, that which is in fact highly scarce, computational competence, is assumed to be in abundance (Pelikan, 1989). In typically

assuming that all individuals can make optimal decisions in a complex environment and when faced with a large number of alternatives, it is implied that every individual has an unlimited ability to process vast amounts of information, a boundless computational capacity, and the analytical abilities of an advanced mathematician.

Otherwise, neoclassical economics generally assumes given, depletable resources. Hence, apart from the computational and analytical competences associated with the rationality assumption, other managerial or labour skills are regarded as given. Yet in reality they are not strictly confined: the skills of a manager or a worker can be enlarged. These resources are not strictly limited or given *ex ante* because of the phenomenon of “learning by doing”. As Hirschman (1985, p. 16) points out: “Use of a resource such as a skill has the immediate effect of improving the skill, of enlarging (rather than depleting) its availability”. So, while competences are genuinely scarce, they are not simply given – they have to be developed. We are thus dealing with a problem of creation and production, rather than simply the allocation of given resources.

That the knowledge within a corporation relates essentially to the organization and the group, rather than to the individuals composing them, is significantly emphasized by Winter. He writes that: “it is undeniable that large corporations are *as organizations* among society’s most significant repositories of the productive knowledge that they exercise and not merely an economic contrivance of the individuals currently associated with them” (Winter, 1988, p. 170). Winter (1982, p. 76) elaborates elsewhere:

The coordination displayed in the performance of organisational routines is, like that displayed in the exercise of individual skills, the fruit of practice. What requires emphasis is that ... the learning experience is a shared experience of organisation members ... Thus, even if the contents of the organisational memory are stored only in the form of memory traces in the memories of individual members, it is still an organisational knowledge in the sense that the fragment stored by each individual member is not fully meaningful or effective except in the context provided by the fragments stored by other members.

Accordingly “it is firms, not the people that work for firms, that know how to make gasoline, automobiles and computers” (*ibid.*). Note also that Masahiko Aoki (1990) writes of the collective nature of employee knowledge in the firm. Since “learning and communication of employees take place only within the organizational framework, their knowledge, as well as their capacities to communicate with each other are not individually portable” (p. 45). Similar points are stressed by Dosi and Marengo (1994, p. 162): “organizational knowledge is neither presupposed nor derived from the available information but rather emerges as a property of the learning system and is shaped by the interaction among the various learning processes that constitute the organization”. Related points are made by William Lazonick (1994, p. 247): “Innovation is social process that requires the conscious involvement ... of many people with a variety of specialized skills and functions. Innovation requires collective organization because it is complex, cumulative and continuous”. Teece and Pisano (1994, pp. 544-5) elaborate a similar theme:

While individual skills are of relevance, their value depends upon their employment, in particular organizational settings. Learning processes are intrinsically social and collective and occur not only through the imitation and emulation of individuals, as with teacher-student or master-apprentice, but also because of joint contributions to the understanding of complex problems. Learning requires common codes of communication and coordinated search procedures.

Contrary to the view of information and knowledge as portable and readily transmissible, knowledge is embedded in social structures and is not immediately transparent. This is partly because opportunities for learning within the firm are transaction and production-specific (Teece, 1988). Also learning is an instituted process of interpretation, appraisal, trial, feedback, and evaluation, involving socially-transmitted cognitive frames and routinized group practices which are often taken for granted. Organizational knowledge interacts with individual knowledge but is more than the sum of the individual parts. It is context dependent, culture-bound and institutionalized.

The neglect of production

Mainstream economics often assumes given resources, thereby neglecting production. The analytical preoccupation is with attempts to get the optimal benefit from given resources. In general, contractarian theories of the firm share this bias. In focusing on contracts and transactions, in the contractarian approach attention is shifted away from the production of more resources to the allocation of given goods and services. Furthermore, in transaction cost analysis different governance modes are compared in the context of a given technology. This implies a hermetic separation between social relations and structures on the one hand and technology on the other, enabling a clear conceptual and empirical distinction between production costs and transaction costs. As Ugo Pagano (1991) elaborates, it is also not clear why the causality between technology and organization should run predominantly in one direction. Paul Milgrom and John Roberts (1992, pp. 33-4) highlight some of the theoretical problems involved in trying to separate the production and governance, and their corresponding costs. The transaction costs argument assumes that production costs are given and do not differ across governance or transaction modes. However, technologies are often linked to transaction modes and structures of governance. When technology is endogenously determined, its choice may be for reasons other than cost minimization. All this is fairly obvious once we dispense with a purely "engineering" view of production and see production costs as also affected by social relations between agents. As well as machines, tools and materials, production depends on human activity. Clearly, the ability and motivation of workers to learn will often depend on the organization of production, property rights, and so on. This reinforces the argument that production costs cannot be independent of social relations. Accordingly, an exclusive focus on the minimization of transaction costs is misconceived.

It is a common mistake to treat production as an extension of exchange, or as an “exchange with nature”. This error derives from the assumption of a particular kind of given individual, exclusively engaged in contract and trade, as the sole and ultimate animating force in the economic system. Decisions to buy and sell are seen to impel and determine production, as expressed in the idea of “consumer sovereignty”. Contracts and marketplace decisions are regarded as primary and active, production as consequent and passive. As a result there is no substantial distinction between production and exchange, as the former is seen as being animated by (and even taking the form of) the latter. Once the deal is struck, the wheels of production are essentially predetermined. The law of contract, through appropriate penalties, ensures that the goods will appear at the appointed time and in good order. In this case, all the key choices and actions take place in the determination of the contract itself. Output is assumed to flow mechanically from input. Production is merely an annex of the market; a place where agents act in accordance with the relevant clauses of the deal.

What is neglected here is a key difference between production and exchange. In contrast to a contract involving the exchange of goods, production involves the use of labour and the intentional and ongoing involvement of a worker. Production is the intentional creation by human beings of a good or service, using appropriate knowledge, tools, machines and materials. When we buy a car or a bag of potatoes they pass from the hands of the seller, and we may thus part company. On the contrary, the employment of a worker does not terminate the relationship between the buyer and seller, the employer and employee. As Alfred Marshall (1949, p. 471) noted: “when a person sells his services, he has to present himself where they are delivered. It matters nothing to the seller of bricks whether they are to be used in building a palace or a sewer: but it matters a great deal to the seller of labour”. The good or service being supplied – in this case labour – remains united with its possessing agent.

The fact that the seller of labour remains involved far beyond the specification and conclusion of any employment contract means that the scope for decision and choice is extended. If choice and decision are to be real, there must always be the possibility of acting otherwise. Insofar as individuals have discretion and real choice, and may meaningfully make decisions, there is a degree of indeterminacy and uncertainty (Loasby, 1976; Shackle, 1972). As Herbert Simon (1951) and others have pointed out, labour is not a “passive factor of production”. In modern capitalism, the fact that the worker has not been replaced by a machine may result in part from the fact that an *ex ante*, complete and mechanical specification of the tasks of work is impossible. Employment contracts are imperfectly specified. The terms of the contract cannot be spelt out in full detail because of the complexity of the work process, and the degree of unpredictability of key outcomes. These problems are found in other contracts, but with employment contracts they are particularly severe. For instance, each agent will learn during the execution of the contract, and the agent cannot in principle predict the future knowledge that is to be learned.

There is also a heavy reliance on the types of tacit knowledge associated with productive skills.

The fact that a relationship between buyer and seller necessarily endures after the contract is agreed extends its social and non-contractual dimension. For example, modern industrial relations depend a great deal on the generation of trust within the firm and the development of a climate of commitment and loyalty (Fox, 1974). Attempts to specify these factors in contractual terms would not only be impossible because of the complexities and uncertainties involved, they would also be self-defeating. The whole point about such qualities as loyalty and trust is that they are not reducible to a cost calculus. As Kenneth Arrow (1974, p. 23) remarks on trust: "If you have to buy it, you already have some doubts about what you've bought". Trust and loyalty cannot be modelled adequately in a contractarian framework.

Dynamic evolution versus comparative statics

Another inherent limitation of the contractarian approach must be emphasized. Notably, Williamson has repeatedly admitted that his approach is one of comparative statics. Typically, the incidence of transaction costs in equilibrium is compared in two or more governance structures, and the structure with the lowest costs is deemed to be more efficient. Williamson (1985, pp. 143-4) acknowledges that a shift from considerations of static to those of dynamic efficiency is not encompassed by his theory: "the study of economic organization in a regime of rapid innovation poses much more difficult issues than those addressed here ... Much more study of the relations between organization and innovation is needed".

As Pagano (1992) explains, the "new" institutional economics of Williamson and others has downplayed matters of disequilibrium. Analytically, the adoption of an equilibrium approach ignores the difference between *ex ante* and *ex post* forms of coordination. Firms and markets have different coordinative capabilities in dynamic, disequilibrium situations. Firms, through foresight and planning can have advantages *ex ante*; markets typically coordinate *ex post*. This possible and additional reason for the existence of firms is ignored in equilibrium and comparative static analyses.

The neglect of technological innovation and dynamic change is indeed a most serious problem for the equilibrium-oriented approach (Hodgson, 1988, pp. 212-3; Nooteboom, 1992, pp. 284-5). Accordingly, Bengt-Åke Lundvall (1993, p. 62) concludes that the failure to incorporate innovation is a serious weakness of the static, transaction cost approach: "one ought to supplement and correct the approach by bringing 'innovation as a process of interactive learning' to the centre of analysis". Consideration of static rather than dynamic efficiency is rooted in the comparative statics of Williamson and Coase. Yet the ability of the firm to foster human learning, technological innovation, and research and development may be a central reason for its existence. It is now widely accepted that learning and technical change cannot be adequately accommodated in a static framework.

Future knowledge is by its nature unknown and the results of research and development are uncertain, in the most radical sense. Uncertainty, in the radical sense of Knight (1921) or Keynes (1936), applies to situations where the calculation or attribution of a numeric probability is impossible: “the price of copper and the rate of interest 20 years hence, or the obsolescence of a new invention ... About these matters there is no scientific basis on which to form any calculable probability whatever. We simply do not know” (Keynes, 1973, pp. 113-4). Arguably, such ignorance makes the attachment even of subjective probabilities implausible. This insurmountable difficulty in the specification of outcomes makes the existence of complete futures markets for all innovations and knowledge impossible. Prediction of specific events in a complex and uncertain world is severely constrained and generally analytically irreducible to probabilistic risk. The existence of radical uncertainty in these and other areas means that the future is not reducible to the present – for instance by means of probabilities. For this reason contracts cannot cope fully with the future.

In these circumstances substantial reserves of skills and material resources are required as buffers to deal with contingencies. If these contingencies could be reduced to quantifiable probabilities then they could be readily dealt with by means of subcontracts and insurance. It is because they are not readily quantifiable in this manner that the firm comes in. It has the scale, and the material and complex human resources to cope with uncertainty. The firm may cope with uncertainties by lumping them together within a single organization, which has resources to bear many unquantifiable and unforeseeable shocks. Such arguments are traceable to Knight, who argued that the existence of the firm “is the direct result of the fact of uncertainty” (1921, p. 271). An emphasis on radical uncertainty is also found in the writings of Brian Loasby (1976), Neil Kay (1984), Richard Langlois (1984) and others. Like Knight, these authors regard the firm’s capacity to cope with radical uncertainty as a central factor in the explanation of its existence. The focus on uncertainty reinstates the concept of time and further moves us from comparative statics.

With the above considerations the analysis of the firm is put on a quite different track. Recognition of the firm as a means of coping with uncertainty is crucial. Uncertainty is not only about future events themselves but also about the opportunities available. In the context of an uncertain world, the analysis of human behaviour has to be centred on the development of capabilities to deal with complexity and change, and on the modes of generation and transmission of knowledge about the evolving socio-economic environment.

In a dynamic perspective the exclusive focus is no longer on equilibrium outcomes. Out of equilibrium, greater diversity of structure and performance is possible. As Jack Downie (1955), Edith Penrose (1959), Wilfred Salter (1960) and Joseph Steindl (1952) indicated – in four classic studies that have suffered unwarranted neglect – there are often enormous and sustained variations in productivity between different firms in the same industry. This contrasts with the textbook picture of firms being driven towards the same long-run equilibrium where costs (and revenues) are typically the same across firms. A

dynamic and open-ended approach challenges the relevance of a long-run equilibrium and admits an ongoing diversity of outcomes. Penrose in particular took on board the central importance of firm heterogeneity and related it to the notion of firm-specific knowledge accumulation. Along with the equilibrium framework of mainstream economics, the Marshallian hypothesis of the “representative firm” was discarded. The emphasis on dynamics and learning in an out-of-equilibrium context enables a more satisfactory accommodation of the real world fact of firm heterogeneity (Eliasson, 1991; Metcalfe, 1988; Nelson, 1991).

The genesis of competence-based theories of the firm

It should not be assumed that competence-based theories of the firm are uniform or consistent. Indeed, a variety of approaches could be grouped under this heading. Furthermore, there is not yet a consensus over terminology and key concepts. Nevertheless, the outlines of this general approach are visible. This will be sketched by discussing in brief the works of three major authors who have played a crucial role in the development of the competence-based approach.

Adam Smith

The genesis of the competence-based theory of the firm can be traced back to Adam Smith (Foss, forthcoming). In his *Wealth of Nations* (1776) Smith argued that the division of labour within the firm meant that workers could specialize and enhance their skills through learning-by-doing. Labour productivity was thus increased. This productivity growth in turn led to more sales and the enlargement of the market. In turn, greater demand for products encouraged factory-owners to expand their activities and subdivide the labour process even further. Smith thus described a process of cumulative causation: a virtuous circle of economic growth and prosperity. This was not a story of static equilibrium, instead a tale of dynamic growth and development, in which individual skills are progressively enhanced.

However, in some respects Smith’s account is incomplete. Williamson (1975) shows that Smith failed to provide an explanation of which production had to be organized within a firm. The division of labour in production could enhance productivity growth even if the workers were self-employed contractors, buying raw materials and semi-finished products and selling the items after their particular task was completed. Following Coase (1937), Williamson argues that the firm becomes an advantageous creation when the transaction costs of detailed, individual-to-individual trading are significantly in excess of firm-based organization and employment contracts. This transaction cost argument has proved to be powerfully persuasive for many economists. Competence-based theories of the firm must either supply an alternative explanation or incorporate the transaction cost argument as a part of a hybrid theory. The latter option is explicitly or implicitly adopted by several theorists.

In addition, while Smith recognized the benefits of the division of labour through some enhancement of skills, what is missing in his writings is an idea of corporate culture and the organization's role in the generation, transmission and protection of practical knowledge. As Edwin Cannan (1929, p. 122) pointed out, Smith tucked away the whole question of the "increase of knowledge under the wings of his exposition of the advantages of the division of labour". Instead of information and knowledge, Smith (1970, p. 112) writes principally of "the increase of dexterity in every particular workman". Thus Smith sees the specific benefit of learning-by-doing that emanates from the division of labour as primarily one of manual dexterity. Wider notions of learning, knowledge and culture are not prominent. True, he considers in some detail the mental as well as the manual division of labour. However, his implicit separation of the processes of conception and execution in the labour process – prefiguring Frederick Taylor and "scientific management" – robs manual labour of tacit or other knowledge and denies the unity of knowing and doing. Furthermore, although Smith puts technological change to the forefront, this is not linked explicitly and primarily to an increase in knowledge but to an increase of physical capital goods. Apart from an increase of manual dexterity, the worker's aims and conceptions remain unchanged[5].

To a considerable degree, the critique of Smith by the German economist Friedrich List in his *National System of Political Economy*, first published in 1841, is relevant here. List (1904, pp. 182-3) criticized Smith for neglecting the importance of both non-material and unexchangeable factors in enhancing the productive potential of a nation. List (1904, p. 108) also wrote: "*The causes of wealth are something totally different from wealth itself ... The power of producing wealth is therefore infinitely more important than wealth itself*". Furthermore, Smith "did not recognize the difference between productive power and mere values of exchange, and did not investigate the former independently of the latter" (List, 1904, p. 120). List contended that considerations of productive potential and – in modern parlance – dynamic efficiency could not be reduced solely to current costs and prices. He argued that the productive powers of a nation are greater than the sum of the productive powers of the individuals within it, considered in isolation, because of the productive benefits provided by the national infrastructure and culture. If we apply this thesis to organizations rather than nations then we derive a key proposition germane to the competence-based theory of the firm.

Like Smith, Marx (1976) in *Capital* also put emphasis on the dynamic processes of production. However, with the rise of neoclassical economics in the 1870s, attention was shifted away from the processes of production and towards the market. The firm became represented less as an organization and more as a set of cost and revenue curves. Although he was responsible for much of this neoclassical analysis, Marshall (1949, p. 115) also emphasized other factors:

Capital consists in a great part of knowledge and organisation ... Knowledge is our most powerful engine of production ... Organisation aids knowledge; it has many forms ... it seems best sometimes to reckon organisation apart as a distinct agent of production.

However, this important recognition of the role of organization and knowledge was not pursued sufficiently, and was largely ignored by Marshall's neoclassical followers.

Frank Knight

Almost a century and a half after the appearance of *The Wealth of Nations*, another major milestone in the development of the competence-based theory of the firm was established by Frank Knight (1921). Knight gave much greater stress to the role of knowledge in his theory of the firm and emphasized the pervasiveness of uncertainty. Indeed, as noted above, it was the "fact of uncertainty" that explained the existence of the firm. Knight (1921, p. 244) saw the firm as a means of coping with uncertainty by "grouping" together activities in larger units of organization:

The difference between free enterprise and mere production for a market represents the addition of specialization of uncertainty-bearing to the grouping of uncertainties, and takes place under pressure of ... the anticipation of wants and control of production with reference to the future.

What is involved here, however, is not the mere addition of competences and activities under an organizational umbrella. To cope with uncertainty, a system of "cephalized" and hierarchic management and administration evolves:

When uncertainty is present the task of deciding what to do and how to do it takes the ascendancy over that of execution, the internal organization of the productive groups is no longer a matter of indifference or a mechanical detail. Centralization of this deciding and controlling function is imperative, a process of "cephalization", such as has taken place in the evolution of organic life, is inevitable, and for the same reasons as in biological evolution (Knight, 1921, pp. 268-9).

(The use of a biological metaphor should be noted.) Notably, however, uncertainty can never be eradicated and action in such a context requires judgement and other elusive entrepreneurial skills. Typically, and especially in unique cases, these skills are tacit, idiosyncratic and unmeasurable:

The receipt of profit in a particular case may be argued to be the result of superior judgement. But it is a judgement of judgement, especially one's own judgement, and in an individual case there is no way of telling good judgement from good luck, and a succession of cases sufficient to evaluate the judgement or determine its probable value transforms the profit into a wage (Knight, 1921, p. 311).

It is a key role of management in the firm to cope with uncertainty by exercising judgement and developing such capacity for judgement in others:

The fundamental fact of organized activity is the tendency to transform the uncertainties of human opinion and action into measurable probabilities by forming an approximate evaluation of the judgement and capacity of the man. The ability to judge men in relation to the problems they are to deal with, and the power to "inspire" them to efficiency in judging other men and things, are the essential characteristics of the executive. If these capacities are known, the compensation for exercising them competitively imputed and is a wage; only, in so far as they are unknown or known only to the possessor himself, do they give rise to a profit (*ibid.*).

Knight thus implies that not all economic competences – particularly that relating to the exercising of judgement in a climate of uncertainty – can be given a market value. Knight's implicit answer to the question "why do firms exist?" is different from that provided by Coase and Williamson. It is not fundamentally because of the higher transaction costs that the firm cannot be broken down into self-employed producers trading with each other. It is because a complete market for all entrepreneurial and managerial skills is impossible in principle.

In his classic paper on the firm, Coase (1937, pp. 400-1) attempted to rebut Knight's argument, writing: "We can imagine a system where all advice or knowledge was bought as required". Coase thus misses the point. Compared with goods and other services, knowledge cannot be so readily "bought as required" (Foss, 1996). Consider first the famous problem later highlighted by Arrow (1962); we do not know the value and nature of information until after it is purchased. Even more seriously, as Knight (1921, p. 268) argues, uncertainty and ignorance create the "necessity of acting on opinion rather than knowledge". Thus what is involved with managerial and entrepreneurial skills is not mere information or knowledge but sophisticated but essentially idiosyncratic judgements and conjectures in the context of uncertainty. Further, as Knight alludes with his identification of the problem of "judgement of judgement" – and as Pavel Pelikan (1989) has later elaborated – the purchase or allocation of competence itself require competence: there is a potential problem of infinite regress. Indeed, as Knight (1921, p. 298) himself writes: the problem "of selecting human capacities for dealing with unforeseeable situations involves paradox and apparent theoretical impossibility of solution".

This is a key difference between contractual and competence-based theories of the firm. Coase regards all managerial and entrepreneurial competences as potentially contractible whereas Knight denies that they all can be. Knight's emphasis on uncertainty and on the (idiosyncratic) nature of judgement required to cope with it, provides an argument for the limits of contractual exchange. Just as Durkheim insists that there are non-contractarian elements to any contract, Knight argues that in a context of uncertainty some competences cannot be usefully or readily bought or hired.

When an entrepreneur spots a new and hitherto unrecognized market opportunity, he or she is exercising an idiosyncratic and peculiar skill. Accordingly, as Nicolai Foss (1993, p. 136) points out:

Fundamentally, there are two different ways in which an actor may realize the rents from his own specific assets: He can sell his services through a contractual relationship, or start a firm. Because of the idiosyncrasy of entrepreneurial competence, the first option is generally blocked: There does not in the market exist a way to evaluate the entrepreneur's worth...

This is much more than a matter of excessive transaction costs. Concerning such competences no adequate cost calculus is possible. Similarly, Teece and Pisano (1994, p. 540) write:

The very essence of capabilities/competences is that they cannot be readily assembled through markets ... the properties of internal organization cannot be replicated by a portfolio of business units amalgamated through formal contracts, as the distinctive elements of

internal organization simply cannot be replicated in the market. That is, entrepreneurial activity cannot lead to the immediate replication of unique organisational skills through simply entering a market and piecing the parts together overnight.

The latter quotation, from two leading developers and exponents of the competences or capabilities approach to the theory of the firms, shows the importance of the recognition of the limits to contracts and markets within organizations. One of the major architects of this insight was Knight, although his contribution is not always recognized. Knight was primarily responsible for emphasizing the role of knowledge and uncertainty in the analysis of organizations, marking a major advance on the work of earlier economists, including Smith. However, in subsequent years, Knight's path breaking analysis of the firm had more influence on macroeconomics, through its general emphasis on uncertainty, than on the theory of the firm. Like Coase's seminal paper of 1937, Knight's book was frequently cited but little read.

Edith Penrose

There is a number of points of similarity between Knight's argument and another neglected classic, *The Theory of the Growth of the Firm* (1959) by Edith Penrose. This work is one of the key statements in the development of the competence-based theory of the firm. Like Knight, Penrose (1959, p. 24) saw the firm as the organized combination of competences: "a firm is more than an administrative unit; it is also a collection of productive resources the disposal of which between different uses and over time is determined by administrative decision". Again redolent of Knight, she wrote "A firm needs a variety of 'reserves' for its operation, whether they be financial reserves, inventory reserves, or labour reserves" (Penrose, 1959, p. 94). Implicitly, such reserves are required in order to cope with uncertainty.

Just as Knight alluded to the idiosyncratic nature of non-routine judgement, Penrose (1959, p. 53) gave stress to the tacit and elusive nature of skills. Much knowledge, she argued, cannot be formally taught, or communicated by language. It is the "result of learning, but learning in the form of personal experience ... experience itself can never be transmitted; it produces a change – frequently a subtle change – in individuals and cannot be separated from them". This learning through experience "shows itself in two ways – changes in knowledge acquired and changes in the ability to use knowledge". Penrose thus recognized uncertainty but her theory was also built on the tacit or unteachable nature of much of the operational knowledge within the firm.

The dynamic development of tacit knowledge and other capabilities was the centrepiece of her theory. She thus focused on the growth of the firm rather than equilibrium conditions, criticizing the orthodox theory of the firm because within it "there is no notion of an *internal* process of *development* leading to cumulative movements in any one direction" (Penrose, 1959, p. 1, emphasis in original). Her theory was one of endogenous change and development rather than movements along or shifts in cost and revenue curves: "the 'firm' must be endowed with many more attributes than the 'firm' in the theory of the firm,

and the significance of these attributes is not conveniently represented by cost and revenue curves” (Penrose, 1959, p. 14).

A key idea in this theory of endogenous change, like that of Smith long before, was that of learning by doing: “That the knowledge possessed by a firm’s personnel tends to increase automatically with experience means, therefore, that the available productive services from a firm’s resources will also tend to change” (Penrose, 1959, p. 76). Penrose thus offered a theory of the growth of the firm based on the enhancement of its competences. However, what is involved here is not mere growth by extrapolation. Typically, growth also involves change and development within the firm itself: “both an automatic increase in knowledge and an incentive to search for new knowledge are, as it were, ‘built into’ the very nature of firms possessing entrepreneurial resources of even average initiative” (Penrose, 1959, p. 78).

Further, competences within the firm are both context-dependent and organically related to each other:

When men have become used to working in a particular group of other men, they become individually and as a group more valuable to the firm in that the services they can render are enhanced by their knowledge of their fellow-workers, of the methods of the firm, and the best way of doing things in the particular set of circumstances in which they are working (Penrose, 1959, p. 52).

Another passage makes a similar point:

Businessmen commonly refer to the managerial group as a “team” and the use of this word implies that management in some sense works as a unit. An administrative group is something more than a collection of individuals; it is a collection of individuals who have had experience in working together, for only in this way can “teamwork” be developed. Existing managerial personnel provide services that cannot be provided by personnel newly hired from outside the firm, not only because they make up the administrative organisation which cannot be expanded except by their own actions, but also because the experience they gain from working within the firm and with each other enables them to provide services that are uniquely valuable for the operation of the particular group with which they are associated (Penrose, 1959, p. 46).

Competences do not reside merely in individuals: they are dependent on the organizational context. Typically they have a social and organic quality, many depending on the shared experiences and interactions within the firm.

In discussing the limits to the growth of firms, Penrose (1959, p. 5) showed “not only that the resources with which a particular firm is accustomed to working will shape the productive services its management is capable of rendering ... but also that the experiences of management will affect the productive services that all its other resources are capable of rendering”.

In sum, Penrose saw the firm as a complex and structured combination of competences and resources. Placing emphasis on organization and managerial competences, Penrose saw the firm as undergoing a process of constrained but cumulative development. Similar ideas lay behind Alfred Chandler’s (1962, 1977, 1990) magisterial studies of the historical development of the capitalist

firm. These influential and detailed historical investigations further paved the way for the competence-based approach.

Ironically, Edith Penrose (1952) had provided one of the most forceful critiques of the use of biological and evolutionary analogies in economics[6]. She could not have known that the next major step in the development of the competence-based theory of the firm was made by Nelson and Winter, and expressed in a book where they made full use of an evolutionary analogy from biology to understand the processes of economic change. This book is featured in the next section.

Evolutionary theories of the firm

Emergence and precedents

The term “evolutionary” can be defined in a number of ways. Here it is used to refer to the deployment of analogies or metaphors taken from evolutionary biology. Although Alfred Marshall had turned to biology for inspiration in his *Principles of Economics* and a few years later Thorstein Veblen suggested that the metaphor of Darwinian evolution could be applied to economics, the development of the evolutionary theory of the firm is largely a post-1945 phenomenon. In part it emanates from a famous controversy about the assumption of profit maximization in economics. Armen Alchian (1950) entered into this controversy and contended that, for the purposes of the debate, it did not matter whether firms were trying to maximize or not. Market competition created an environment akin to natural selection where the more efficient would win out. Selective success, Alchian argues, depends on behaviour and results, not motivations. Furthermore, because agents operate in a world of uncertainty and may react in different ways to given stimuli, individual behaviour is not predictable. Nevertheless, even if firms never actually attempted to maximize profits, “evolutionary” processes of selection and imitation would ensure the survival of the more profitable enterprises. Thus Alchian saw the idea of evolutionary selection less as a buttress and more as an alternative to the assumption that individual firms are actually attempting to maximize their profits. Although individual behaviour cannot be predicted, evolutionary processes ensure that patterns of development can be observed in the aggregate.

Edith Penrose (1952) responded with a penetrating critique of the use of the biological analogy in economics. She argued that the analogy was misconceived, for at least two reasons. First, human agents are guided by purposes and intentions whereas Darwinian natural selection assumes that organisms are simply programmed by their genes. Second, the analogy was abused because there was no equivalent in the socio-economic sphere to durable, heritable traits. Accordingly, there is nothing durable on which socio-economic “natural selection” can operate.

Nevertheless, these important criticisms were largely ignored and the “natural selection” idea was taken up by others, notably by Milton Friedman in a famous and frequently quoted essay published in 1953. It is important to note

that Alchian had no intention of laying the basis of an “evolutionary” or alternative theory of the firm with his article. What he did was to reintroduce an evolutionary and biological analogy back into economics which had been neglected after the deaths of Alfred Marshall and Thorstein Veblen in the 1920s.

Core concepts in evolutionary theories

Subsequently Winter (1964) wrote an extensive critique of Friedman’s “natural selection” defence of the assumption of profit maximization. However, instead of rejecting the biological analogy, he showed that rather special and restrictive conditions were required for market competition to produce the results that Friedman presumed. He demonstrated that under plausible conditions the “natural selection” of profit maximizers would not work (Hodgson, 1994).

Winter pointed out that Friedman’s “natural selection” argument was imperfectly specified in that it did not show how maximizing behaviour was replicated through time. For selection to work there must be some sustaining feature that ensures that the maximizers or near-maximizers that are “selected” through competition will continue for some time in that mode of behaviour. As Penrose had already pointed out, for natural selection to work there must be heritable variation in fitness. The heritable element was missing from Friedman’s account. For selection to operate consistently in favour of some characteristics rather than others, behaviour cannot be purely accidental. There has to be some equivalent to the genetic constitution or genotype, such as the structural characteristics, routines or culture of the firm, which fixes, determines, moulds or constrains the phenotype in some way.

Winter suggested that routines in the firm have a relatively durable quality through time. They may help to retain skills and other forms of knowledge, and to some extent they have the capacity to replicate through imitation, personal mobility, takeovers and so on. Further, routines can change through managerial or other action when the firm’s profits are below a satisfactory level. As he put it in later article: “The assumption that firms have decision rules, and retain or replace them according to the satisficing principle, provides both genetic stability and an endogenous mutation mechanism” (Winter, 1971, p. 247). (The “satisficing principle” refers to Herbert Simon’s idea that firms attempt to obtain satisfactory minima, rather than optimizing, in their behaviour.)

Hence Winter’s work was a partial answer to Penrose as well as a direct attack on Friedman. Winter discovered in the routine an answer to Penrose’s complaint that there the heritable mechanisms were not clearly specified in earlier presentations of the evolutionary analogy in economics. He thus inadvertently returns to the ideas of Veblen (1919) and the “old” institutionalists concerning the centrality of habit and routine in economic life, and the way in which habits and routines encapsulate working knowledge.

On this basis an evolutionary theory of the firm was built, in collaboration with Nelson. In 1982 they published their classic *An Evolutionary Theory of Economic Change*. To their joint venture, Nelson brought his rich theoretical and empirical knowledge of industrial economics, and Winter carried the

important theoretical innovations that he had made to reinstate in economics the evolutionary analogy from biology. The inspiration provided by this analogy was crucial and explicit. The term “evolutionary” was adopted as “above all a signal that we have borrowed basic ideas from biology, thus exercising an option to which economists are entitled in perpetuity by virtue of the stimulus our predecessor Malthus provided to Darwin’s thinking” (Nelson and Winter, 1982, p. 9).

Both authors shared a deep anxiety about the theoretical, empirical and practical limitations of neoclassical economics. This uneasiness is so profound that it leads to a rejection of the core assumptions of neoclassical economic theory. The “reliance on equilibrium analysis, even in its more flexible forms, still leads the discipline blind to phenomena associated with historical change”. Furthermore, “although it is not literally appropriate to stigmatize orthodoxy as concerned only with hypothetical situations of perfect information and static equilibrium, the prevalence of analogous restrictions in advanced work lends a metaphorical validity to the complaint”. Finally, they reject “the assumption that economic actors are rational in the sense that they optimize” (Nelson and Winter, 1982, p. 8).

Accordingly, Nelson and Winter developed an alternative theoretical framework to profit maximization for the analysis of the firm. Instead of such an optimizing procedure, they propose an evolutionary model in which selection operates on the firm’s internal routines. Routines include “characteristics of firms that range from well-specified technical routines for producing things, through procedures for hiring and firing, ordering new inventory, or stepping up production of items in high demand, to policies regarding investment, research and development (R&D), or advertising, and business strategies about product diversification and overseas investment”. In their analysis “these routines play the role that genes play in biological evolutionary theory” (p. 14).

Routines are not simply widespread and characteristic of much activity within organizations: they also have functional characteristics. Being concerned to show how technological skills are acquired and passed on within the economy, Nelson and Winter argued that habits and routines act as relatively durable repositories of knowledge and skills. In their words, routines are the “organizational memory” (p. 99) of the firm. Furthermore, routines may have the capacity to replicate through imitation, personal mobility, and so on. Because of their relatively durable character and their capacity to replicate, routines act as the economic analogue of the gene in biology. They transmit information through time in a manner which is loosely analogous to the conservation and replication of information via the gene.

However, it is freely accepted that innovative activity is possible and much business behaviour is not essentially routine. Such irregular and unpredictable behaviour was accommodated in their evolutionary theory “by recognizing that there are stochastic elements in the determination of decisions and decision

outcomes” (p. 15). Here again there are clear parallels in the biological theory of evolution where stochastic variation is important in many evolutionary models.

Just as the routine is the analogue of the gene, Nelson and Winter borrow a second key concept directly from evolutionary biology. They develop the concept of “search” to encompass changes in the routines of firms: “Our concept of search obviously is the counterpart of that of mutation in biological evolutionary theory” (p. 18). This concept was illustrated by the evolutionary model in chapter 9 of their book. A threshold level of profitability is assumed. If firms are sufficiently profitable they attempt to maintain their existing routines and do no “searching” at all. Here Nelson and Winter adopt Herbert Simon’s important “satisficing” idea: agents attempt to gain a given “aspiration level” rather than to optimize. However, if profitability falls below this level then “firms are driven to consider alternatives ... under the pressure of adversity” (p. 211). They invest in R&D and attempt to discover new techniques so that profitability can be restored.

Third, there is a clear analogue to the idea of economic “natural selection”: “Market environments provide a definition of success for business firms, and that definition is very closely related to their ability to survive and grow” (p. 9). Clearly, this is the application of the analogy of market competition with the “struggle for existence” in biology. In this third case, unlike the preceding two, there is much common ground with Alchian, Friedman and many others. However, unlike most of their predecessors, Nelson and Winter are careful not to endow market selection mechanisms or private ownership with the aura of a “natural” order or the mantle of supreme efficiency.

The adoption of these three crucial analogues completes the link between the Nelson-Winter concept of economic evolution and the corresponding idea in biology. In biology, evolution requires three essential components. First, there must be sustained variation among the members of a species or population. Variations may be blind, random or purposive in character, but without them, as Darwin insisted, natural selection cannot operate. Second, there must be some principle of heredity or continuity through which offspring have to resemble their parents more than they resemble other members of their species. In other words, there has to be some mechanism through which individual characteristics are passed on through the generations. Third, natural selection itself operates either because better-adapted organisms leave increased numbers of offspring, or because the variations or gene combinations that are preserved are those bestowing advantage in struggling to survive. This is the principle of the struggle for existence. Nelson and Winter explicitly appropriate and amend these ideas from biology to build their evolutionary theory. This triad of ideas demarcates their “evolutionary” approach from many different and contending uses of the term (Hodgson, 1993a, ch. 3).

However, while the theoretical approach of Nelson and Winter conforms to these three characteristics of evolutionary biology, they make it clear that it does not amount to an exact correspondence. We have already noted that while routines are relatively sturdy in socio-economic terms they are nearly as durable

as the gene in biology. In addition, when routines change, their new characteristics can be imitated and directly inherited by imitators or subsidiary firms. For this reason, as several evolutionary theorists have pointed out, in the socio-economic sphere the inheritance of acquired characteristics is possible and thereby socio-economic evolution has apparent Lamarckian characteristics. It could also be classed as Lamarckian because – contrary to the gene-programmed behaviour of Darwinism – there is a place for intentionality and novelty in human behaviour (Hodgson, 1993a, ch. 14). As a result, it is possible to overcome another objection to the use of the evolutionary analogy raised by Penrose in 1952. Notably, Nelson and Winter (1982) refer to their own approach as Lamarckian rather than Darwinian.

The evolutionary metaphor provided the escape route from the rigidities of neoclassical orthodoxy. Despite many problems and dangers, modern biology is a rich source of ideas and approaches from which a revitalized economics may draw. In all, the application of an evolutionary approach to economics seems to involve a number of advantages and improvements over the orthodox and mechanistic paradigm. For instance, it enhances a concern with irreversible and ongoing processes in time, with long-run development rather than short-run marginal adjustments, with qualitative as well as quantitative change, with variation and diversity, with non-equilibrium as well as equilibrium situations, and with the possibility of persistent and systematic error-making and thereby non-optimizing behaviour.

Evolutionary theories of the firm pay more attention to processes of learning and development within organizations. The agent is an explorer and creator rather than a strict maximizer. The firm is a changing organism, typified by both reactive and purposeful behaviours. Because of its radically different depiction of economic agents and processes, Nelson and Winter's theory marks an intellectual revolution in economics. However, as yet it has had only a limited impact on orthodox opinion. Their work is cited much more frequently in management and business publications, rather than in the core theoretical journals of mainstream economics. One reason why theorists of management and business have been attracted to Nelson and Winter's work is its direct link to competence-based theories of the firm and business strategy.

We shall now examine this connection and explain why Nelson and Winter's work forms a subset of competence-based theories.

Evolutionary theories as a subset of competence-based theories

Echoing Knight and Penrose as well as Veblen, Nelson (1980) criticized the orthodox treatment of information and knowledge – including technological knowledge – as codifiable and cumulative. He rejected the common idea that “technological knowledge is in the form of codified how-to-do-it knowledge which provides sufficient guidance so that if one had access to the book one would be able to do it” (p. 63). Also discarded is the notion that such knowledge is easily or directly expanded by expenditure on research and development: “If the salient elements of techniques involve special personal skills, or a

personalized pattern of interaction and co-operation among a group of individuals in an important way, then one cannot easily infer how it would work from an experiment conducted elsewhere” (p. 67).

This idea of knowledge as largely tacit, idiosyncratic, and context dependent was incorporated in Nelson and Winter’s book and forms a key part of their theory. It connects to their core theoretical concept of the routine. The idea of knowledge being embedded in routines is a particular presentation of the concept of competences or capabilities which is the defining notion in competence-based theories.

The use of the evolutionary metaphor by Nelson and Winter involved other fundamental conceptual shifts. Traditional neoclassical theory had disregarded the industry-wide variety of organizations and behaviours; the equilibrium framework suggest a population of surviving and equally efficient firms. The move away from equilibrium thinking and the incorporation of a metaphor of ongoing biological selection meant thus the establishment of a theory where firm differences were possible, and mattered. The key reasons for this divergence lay in the fact that individuals can interpret given information in a variety of ways, the fact that responses to external stimuli can be varied, and the fact that idiosyncratic and firm-specific information is the rule. As noted above, earlier exponents of a competence-based theory of the firm – particularly Penrose (1959) in her dynamic framework – had also stressed the variety of organizational and behavioural possibilities and the existence of firm heterogeneity. However, the biological metaphor was not always the inspiration for this idea (Nelson, 1991).

Despite the abstract and theoretical nature of Nelson and Winter’s 1982 treatise, subsequent work by both authors has shown direct and fruitful applications to industrial policy and strategic management. The application of this broad theoretical approach to management practice is illustrated in Nelson (1991) and a number of other works. For instance, Nelson (1993) has also developed a pioneering analysis of “national systems of innovation”. The argument here was that innovation and technical change are not simply matters for individual entrepreneurs, but also involve cultural and institutional features at the national level. The work of Nelson and others in this area is currently one of the most fruitful policy-oriented areas of economics research (Lundvall, 1992). Broadly, this work imports and develops the idea of knowledge as largely tacit, idiosyncratic and context dependent. Competences are established and developed within an appropriate framework of institutions and culture. The metaphors of evolutionary selection and mutation can be deployed to describe the general process of development of competences within an economic system. The policy focus becomes one of structuring and guiding these processes in a beneficial way.

The application to strategic management of evolutionary theories in particular and competence-based approaches in general is the subject of the next section.

Applications to strategic management

Fundamentally, the difference of approach asserted by the competence-based perspective is ontological (in emphasizing hidden capacities and powers), epistemological (in insisting on non-positivistic conceptions of learning and knowledge) and methodological (in rejecting explanations ultimately in terms of individuals alone). In contrast to much of mainstream economic theory, the emphasis is on dynamic as well as static efficiency, and on production as well as allocation.

It is the purpose of this section to address a large modern literature in which competence-based approaches have been applied to strategic management. Space prohibits an extensive survey of what is now a large literature. It is, however, possible to identify some cardinal themes. To recapitulate, key features of the modern competence-based approach are as follows:

- There is a recognition of learning-by-doing as a source of endogenous growth. This emphasis on learning and growth means that individuals themselves are in a process of development, in contrast to static and equilibrium-based approaches.
- There is a recognition of the role of radical uncertainty and other chronic problems pertaining to information and knowledge in the firm.
- There is a recognition of tacit knowledge and the way in which it is not merely bound up with individuals but with relationships within the organization and the organizational structure as a whole.
- The aforementioned emphasis on learning and the tacit, idiosyncratic and context dependent nature of knowledge leads to the conclusion that not all activities within the firm are contractible.

The key role of knowledge should be emphasized. Further, knowledge is distinguished from information because knowledge can be obtained only via processes of cognition and interpretation (Cartier, 1994). Typically, contractarian theories do not make or emphasize this distinction, the focus being on information asymmetries rather than the idiosyncratic, organization-bound character of knowledge. Martin Fransman (1994, p. 715) thus makes a distinction between theories of the firm based on "individual and organizational responses to information-related problems" and approaches which see "the firm as a repository of knowledge". The competence-based analyses of Chandler, Nelson, Penrose, Teece and Winter come into the latter category.

In contrast to the standard textbook theory, the firm is not understood principally through its cost and revenue curves. Instead, there is an emphasis on knowledge, learning, routines and other resources. In other words, the competence perspective understands the firm's competitive situation primarily in regard to its resources, rather than its market position. As Richard Rumelt (1984, p. 57) explains, in essence the strategy concept "is that a firm's competitive position is defined by a bundle of unique resources and relationships, and that the task of general management is to adjust and renew

these resources and relationships, as time, competition, and change erode their value”.

This notion that competitive strategy requires both the exploitation of existing internal and external firm-specific capabilities and of developing new ones was suggested by Penrose (1959) and Selznick (1957). It was not until the 1980s that this idea made a major impact on strategic management literature, with the contributions of Barney (1986), Teece (1982, 1988), Wernerfelt (1984) and others.

To some degree there is also a contrast with the approach to competitive strategy advocated by Michael Porter (1980)[7]. Barney (1986) and Ingemar Dierickx and Karel Cool (1989) argue that by concentrating excessive attention on product market strategies, the Porter framework neglects the cost of developing the basis of and implementing those very strategies. Resources must be acquired or built before a product market strategy may be implemented. Again, instead of an exclusive outward orientation toward market niches and advantageous cost-revenue combinations, the competence-based perspective also puts emphasis on building up resources and organizational routines within the firm itself. Organization and production are emphasized, as well as the market. As Teece and Pisano (1994, p. 553) put it:

We posit that the competitive advantage of firms stems from dynamic capabilities rooted in high performance routines operating inside the firm, embedded in the firm's processes, and conditioned by its history. Because of imperfect factor markets, or more precisely the non-tradability of “soft” assets like values, culture, and organizational experience, these capabilities generally cannot be bought – they must be built. This may take years – possibly decades... The capabilities approach accordingly sees definite limits on strategic options, at least in the short run. Competitive success occurs in part because of processes and structures already established and experience obtained in earlier periods.

Accordingly, strategic emphasis is put on learning and the growth of knowledge within the firm. As Ray Stata (1989, p. 64) argues: “the rate at which individuals and organizations learn may become the most sustainable competitive advantage”. This ties in with the work of researchers concerned with “organizational learning” such as Peter Senge (1990). He makes a relevant and useful distinction between adaptive learning, where the organization copes with changes in the external world but does not make any central changes in its shared mental model and, in contrast, generative learning is more creative and significant changes in the shared mental model are made. Obstacles to organizational learning are identified in such research, such as inaccessible and obscure mental models, defensive modes of behaviour, lack of good team work, lack of shared vision, or a lack of a system-wide view by employees.

The competence-based approach also addresses key strategic questions such as the identification of possibilities for advantageous vertical integration. Again the orientation is less towards market evaluations and more towards the building of organizational resources. Rumelt (1974) and Teece *et al.* (1994) argue that because capabilities cannot easily be bought and must be built,

opportunities for growth from diversification are thus likely to be limited, lying “close in” to the firm’s existing lines of product.

It must be noted, however, that different protagonists of the competence-based approach put different emphases on aspects of the analysis. Seeing the dangers in a more static variant of the competence-based approach, Teece and his collaborators advocate an analysis of “dynamic capabilities”. They argue that static variants have proved to be strategically defective:

Well-known companies like IBM, Texas Instruments, Phillips, and others appear to have followed a “resource-based strategy” of accumulating valuable technology assets, often guarded by an aggressive intellectual property stance. However, this strategy is often not enough to support a significant competitive advantage. (Teece and Pisano, 1994, p. 538)

Hence the dynamic aspects of strategy are emphasized:

Winners in the global marketplace have been firms that can demonstrate timely responsiveness and rapid and flexible product innovation, coupled with the management capability to effectively coordinate and redeploy internal and external competences. Not surprisingly, industry observers have remarked that companies can accumulate a large stock of valuable technology assets and still not have many useful capabilities. We refer to this source of competitive advantage as “dynamic capabilities” to emphasise two key aspects which were not the main focus of attention in previous strategy perspectives. The term “dynamic” refers to the shifting character of the environment; certain strategic responses are required when 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. The term “capabilities” emphasises the key role of strategic management in appropriately adapting, integrating, and re-configuring internal and external organisational skills, resources, and functional competences toward changing environment (*ibid.*).

The emphasis on the development of the “core competences” of the corporation raises the question of the identification of that core and its boundaries (Prahalad and Hamel, 1990). Langlois and Robertson (1995, p. 7) address this issue in these terms:

firms and other types of organisations consist of two distinct but changing parts. The first part, the *intrinsic core*, comprises elements that are idiosyncratically synergistic, inimitable, and noncontestable... The remainder of the organisation consists of *ancillary capabilities* that are contestable and may not be unique.

Much of the strategic management literature is concerned with the operationalization of distinctions along these lines. The aim is to identify the strategic focus of the organization. A number of studies suggest that this has implications for such issues as the choice of the appropriate diversification strategy for the firm (Chatterjee and Wernerfelt, 1991; Rumelt, 1974; Wernerfelt and Montgomery, 1978).

Despite a long history stretching back to the birth of modern economics at the end of the eighteenth century, the competence-based approach to the theory of the firm and corporate strategy is still in its infancy. It offers, however, a crucial reorientation away from a market-based analysis and towards organization, knowledge and learning.

Notes

1. Nevertheless, the term “evolution” has been defined by Schumpeter (1954, p. 964) and others in a sense which involves no reference to, or analogy with, biological evolution (see Hodgson, 1993a, ch. 10). Despite this, many evolutionary economists – including some who, like Nelson and Winter, describe themselves as “Schumpetarians” – make extensive use of biological metaphors.
2. Neoclassical economics may be defined as an approach that has the following attributes: (1) the assumption of rational, maximizing behaviour by agents with given and stable preference functions; (2) a focus on attained, or movements towards, equilibrium states; (3) the absence of chronic information problems (there is, at most, a focus on probabilistic risk: excluding severe ignorance, radical uncertainty, or divergent perceptions of a given reality). Notably, these three attributes are inter-connected. For instance, the attainment of a stable optimum under (1) suggests an equilibrium (2); and rationality under (1) connotes the absence of severe information problems alluded to in (3).
3. Some authors prefer the term “resource-based” because it clearly relates to all resources, human and non-human. However, the term “competence-based” is gaining over it in popularity, and it shall thus be adopted here. Few relevant phenomena, including technology-based economies of scale, do not inextricably have human competences at their core.
4. Note that Demsetz’s later position (Demsetz, 1988) is different in some crucial respects from that in his classic joint article with Alchian.
5. Babbage (1846) modified Smith’s account of the division of labour, putting emphasis on the pre-existing variety of skills and competences, as the prior basis for allocating different tasks. Like Smith, however, Babbage’s conception of management is essentially Taylorist in its separation of conception and execution.
6. In a number of verbal statements to the present author and to others prior to her death in 1996, Penrose made it clear that she was much more sympathetic to the employment of evolutionary analogies. However, many of her remarks concerning the limitations of the direct and unmodified application of biological models to economics still apply.
7. Note, however, that Porter (e.g. 1990, p. 73) rightly puts emphasis on learning, and notes that much of modern competition involves shifting the organization’s capacity to learn.

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