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3 Knowledge and capabilities

A new view of the firm

J. Stanley Metcalfe and Andrew James

Introduction

In recent years there has been a remarkable flowering of ideas on the theory of the firm, the principal purpose of which is to break open the black box which normally constitutes the firm and to seek to understand its behaviour in terms of its internal properties, that is to say its capabilities. There are several admirable reviews and commentaries on this literature (Montgomery 1995; Foss and Knudsen 1996; Foss 1997) so we do not intend to repeat their findings here. Rather our purpose is fourfold: to explore the wider significance of the capabilities view in terms of a number of important controversies in relation to the role of firms; to attempt to construct a simple framework in which the main features of the capabilities view can be clearly expressed; to provide some necessary supplements to the capabilities approach in relation to the notions of rationality and knowledge, particularly technological knowledge; and to draw some implications in relation to the role of mergers and acquisitions in enhancing a firm's capabilities. This last theme is particularly significant for us because it involves a movement away from treating capabilities as if they can be generated only within the firm. We should also note here that we shall speak of the firm and its constituent business units interchangeably, thus sweeping under the carpet important distinctions between capabilities at the corporate and at the business level. For the present, this issue remains unfinished business. The framework within which these ideas are developed is evolutionary, and in the conclusion we summarise briefly our understanding of the link between capabilities and economic evolution.

The significance of the capabilities theory of the firm

In this section, we propose to review a number of controversial issues on which a capabilities perspective can shed some important light. In turn, these are the distinctive nature of the firm, the sources of competitive advantage and the nature of competition, the theory of endogenous growth, and the institutional systems approach to the development of technology.

The nature of the firm

There is a long controversy in the economics literature concerning why firms exist and how they differ as organisations from markets as institutions. Typically the contractual perspective which developed from the seminal work of Coase (1937) either explains the existence of firms in terms of the difficulty of writing fully specified contracts between the collaborators in the enterprise, so creating scope for opportunistic behaviour, or emphasises the difficulties in monitoring and evaluating the contributions of the different members of the firm (Alchian and Demsetz 1972). In essence, firms are the consequence of specific market failures in the provision of information which prevent the firm being assembled as a particular, fluid nexus of contracts. The capabilities perspective takes us in a quite different direction. It not only explains why firms and markets are distinctively different, it also explains why firms differ one from another, even in closely related lines of business, something a contracts perspective cannot do. What the capabilities view underpins is the view of the firm as a transformation process not an exchange process: put simply, what is distinctive about the firm is that it determines what is produced and how and to what end (McNulty 1984). Moreover, on this view 'firms' become the necessary prerequisites for the existence of markets and, in many cases, firms provide the information on prices as well as product qualities which market institutions then diffuse to potential customers. Indeed, it is perhaps the false perception of the typical economic transaction involving a homogeneous product exchanged between anonymous parties with prices set by extra-market institutions that has done most to promote the view of the firm as merely a substitute for market arrangements.

The crucial point to comprehend at this stage is that firms and markets as categories are complements not substitutes. The existence of the one depends on the existence of the other: each is the response to the underlying, fundamental phenomena which are specialisation and the division of labour. It is perfectly sensible to imagine a Crusoe-like economy of entirely self-sufficient individuals who neither barter nor trade, but this is not our world. What we have are markets and independent producers. However, it is also clear that specialisation is not itself sufficient to explain the modern firm. We need something else.

This problem is put into sharper focus if we follow McNulty's suggestion and ask why individuals find it beneficial to collaborate in teams? Why does not everybody form his own individual firm? The capabilities-based answer is that collaboration yields productive outcomes which are more highly valued by their customers compared to the outcomes achieved when individuals act in isolation. In short, the *integrated* capabilities of teams have been selected for by market processes. While the contractual perspective on the firm produces negative reasons for the existence of firms, the capabilities perspective relies upon positive arguments. When individuals collaborate in teams they do not simply exchange productive services, for such exchanges can be handled

by market transactions. Team members, however, *interact* in such a way as to make available qualitatively superior productive services. As we explore below, this is because the knowledge of the team is greater than the sum of the knowledge of the isolated individuals through interaction: the firm is a creator of knowledge which is shared between its members to greater productive effect. Thus firms do not simply use available factor services; they transform these services through more roundabout teamwork (Young 1928) by exploiting the gains in knowledge which come from interaction. It is upon the non-linear combination and transformation of factor services that the capabilities approach ultimately depends, and combination and transformation are not possible without organisation. Indeed this is precisely the point made by Penrose (1959) when she distinguished the resources available to the firm from the productive services which could be extracted via managerial knowledge. Resources are accessible through market contracts, but productive services are not. They are created by activities within the firm. Of course, this still leaves open the question of the boundaries of the firm, and of what is within those boundaries, and what is without and necessarily the subject of market relationships (Richardson 1972). Here a perspective which identifies the comparative costs of competing organisational arrangements certainly has an important contribution to make since market selection will, in the long run, result in the dominance of those forms of enterprise which offer the most favourable cost and quality combinations. But this does not explain the existence of firms. Rather, it contributes to an explanation of the different ways in which they operate, and of the way in which some governance forms acquire dominance by market processes. The capabilities approach and the transactions cost approach to the firm are to us complementary and distinctively different.

There are two further aspects of this line of reasoning which should be commented upon. As we shall see below, the capabilities view places special emphasis upon knowledge and the accumulation of knowledge both within the firm and in market arrangements between firms. Now economists have developed good reasons why markets in information are unlikely to be efficient (Arrow 1961) and it would be quite natural to see the firm as an institution necessary for the production of specific proprietary knowledge when there is no market alternative. A second aspect of knowledge is that it must be acquired in indivisible amounts; one cannot produce with an incomplete understanding of the production process or sell with an incomplete understanding of the relevant customers. On the one hand this makes it impossible to deduce the marginal contribution of any one individual's understanding or idea since without the rest of the complementary knowledge its value is undefined. On the other hand, capabilities are created by indivisible investments and their exploitation is always subject to increasing returns. Penrose (1959) understood this well when she drew attention to the twin roles of management in both creating managerial processes and implementing these processes. But creation is a discrete activity: once the new opportunity has been

discovered and the associated activities defined, that portion of management effort is free to be deployed in new areas of investigation. In this way the creativity of the firm in developing new lines of activity becomes contingent upon the division of managerial resources between exploration and exploitation (Dosi and Marengo 1994). Moreover, because of increasing returns, there is pressure to make use of the management team's accumulated stock of intangible assets to the greatest degree consistent with the other constraints on the expansion of the firm. Thus, to Penrose, firms are simultaneously creative and growing. Not surprisingly, a static contracts viewpoint tells us very little about such matters.

Competition and competitive advantage

If the exploitation of capabilities gives rise to increasing returns, this presents a serious difficulty for the equilibrium theory of competition and the firm. But here the capabilities approach makes its second major contribution for it provides the basis, not for competition as a state of affairs, but for competition as a process of change; a process which depends in evolutionary fashion upon firms being different one from another. This change in perspective is profound. First it requires us to abandon methodological essentialism and treat firms in an industry not as collections of identical entities but as distinct individuals (Nelson 1991; Kogut and Zander 1992). One asks not what they have in common but how they are different one from another. This leads naturally to the question of why they are different, which becomes an issue in the differential development of capabilities (Teece *et al.* 1994), that is, the differential ability to innovate considered in the broadest terms. All of this connects directly with evolutionary theories of the competitive process, in which differences in the behaviour of firms create particular characteristics or competitive traits which give selective advantage in the marketplace, that is, relative to the requirements of users and the offerings of rival firms. In turn these selection advantages are reflected in the profitability of the firm and the rate at which it can expand its market position relative to its rivals. Increasing returns do not undermine this process, but enhance its operation. What prevents the ultimate concentration of production in a dominant firm is to be found only in the differential capability enhancing efforts of the other rival firms (Downie 1958; Metcalfe 1998). One immediate consequence of this view is to identify competitive advantage not as an attribute of a firm in isolation but as a consequence of the market interaction of rival firms with different competitive traits. Of course, the possible competitive traits are many in number, and they certainly are not reducible to technological differences; organisation of production and organisation of relationships with customers are equally significant.

In supporting the dynamic basis of competition, a capabilities perspective can usefully distinguish three broad classes of capabilities: capabilities in

Heterogeneity v. capabilities

relation to the conduct of existing activities; capabilities in relation to the growth of those given activities through investments in productive capability and market position; and capabilities in relation to the development of all the firm's activities, including the introduction of new products and processes, entry into new market areas, and the entering into of relationships with other firms through alliances, joint ventures or acquisitions. It is the latter capabilities in relation to acquisition that are of particular significance for this chapter.

Endogenous growth and innovation systems

The third aspect of a capabilities perspective to which we draw attention is the underpinning it provides for theories of endogenous growth and economic policy in relation to economic growth. But contrary to the macroeconomic literature on endogenous growth, the perspective shifts to the microeconomic level. Endogenous growth becomes a matter of the accumulation of capabilities in firms and the growth in the economic application of those capabilities. It involves structural change in a fundamental way between broad sectors and within sectors as firms compete for market advantage. We can certainly measure the growth outcome of these processes at the macroeconomic level but we cannot comprehend them at the macroeconomic level. Thus the capabilities perspective provides us with the material to develop an understanding of economic growth very much in the tradition of Adam Smith and Alfred Marshall.

One implication of this is also to provide a framework for growth policy. One of the important themes here is that firms do not develop capabilities solely through their own isolated efforts; rather they are connected within a matrix of other capability supporting institutions. This is precisely the perspective which is developed in the innovations systems literature (Nelson 1993; Edquist 1997; McElvey 1996; Lundvall 1992; Carlsson 1995) and it tells us that firms develop their capabilities by interacting with customers, suppliers and other knowledge and skill generating institutions in the public and private sectors. It matters whether or not a firm can engage in discussion with intelligent customers and suppliers and with other high-quality knowledge generating institutions. Indeed a capability to interact in this way is surely a major determinant of long-term competitive advantage. The significance of this for growth and innovation policy is that it is the operation of this wider set of capability supporting institutions that provides the conduit for policy initiatives: to build an appropriate capabilities support infrastructure and to ensure that firms connect with it via networks or whatever becomes the central policy concern.

Having sketched several of the fields of enquiry which are illuminated by the capabilities approach to the firm, it is time to explain more clearly its nature. A necessary prelude to this is to consider some of the issues raised by rationality and the accumulation of technological knowledge.

Rationality, imagination and innovation

One of the issues we must confront at the outset is the relationship between firm behaviour and rational decision making. This is a complex matter and no serious student of the innovation process has ever put much faith in the extreme idea of rationality, which is otherwise so prevalent in modern economy theory. Let us start by accepting a far less restrictive version of rationality as reasoned behaviour, the directed, intentional behaviour of firms seeking competitive advantage by committing resources to innovation. Such behaviour is motivated, it involves striving (Winter 1984) and it entails no more than decision making and thus choice which seeks to do the best with the resources at the command of the firm or innovating business unit.

The arguments in favour of reasonable rationality as distinct from Olympian rationality are, we believe, compelling, and they help us understand why firms come to develop in such widely different ways. Olympian rationality, it will be recalled, requires a full specification of all the relevant options from which choices are to be made, and a full evaluation of how each option contributes to the objectives of the rational decision maker, including options whose consequences lie entirely in the future. In the field of innovation neither Olympian prerequisite seems remotely plausible: where innovations are concerned neither what is considered best nor the resources considered to be available are free from ambiguity.

When problems become too complex to be well defined let alone solved analytically, one is inevitably reduced to judgement and the guiding hand of experience (Lane *et al.* 1995). Complexity implies that there is no single metric to reduce choices to a comparable basis, that there is computational indeterminacy in translating between options and objectives, and that there is an ineluctable range of ignorance which means that decisions can only be made on the basis of expectation and hunch. To the extent that optimisation occurs at all, i.e., that there is reasonable behaviour, it takes place within local domains in which the choice set and the evaluation of that choice set are historically contingent. Of itself this is quite enough to underpin the diversity of firm behaviour which is the chief empirical characteristic of the development process in modern capitalism.

But there is so much more to bounded rationality than the notion that it is simply rationality with extra constraints. The much more fundamental issue is the question of the exercise of imagination and the construction of the choice sets for change. Just what are the options for development? Langlois (1990), for example, along with many others in the Shackle (1961)/Simon (1955) tradition, has pointed out the fundamental problems that arise in compiling the list of potential choices, problems relating to the imagination required to construct the relevant choice set. Here it is important to remember that bounded rationality is too often interpreted negatively, as an unfortunate and unavoidable deviation from comprehensive rationality. This misleads greatly, for it hides the positive side of boundedness, namely the

freeing of the imagination to conceive new configurations of knowledge. Liberated from the constraints of received wisdom, one can genuinely innovate (Loasby 1991). This is perhaps why technology so often develops ahead of an understanding of the relevant laws of nature or understanding of human behaviour. Vincenti's (1997) account of the realisation of supersonic flight in advance of any scientific theory, indeed in the face of theoretical predictions that it might be impossible, is a good case in point. Perhaps we underestimate the extent to which genuine innovation is contingent upon ignorance.

Within evolutionary epistemology this issue is closely connected with the question of 'where guesses come from' (Stein and Lipton 1989), a problem in the generation of variety and the subsequent selection of options from that range of possibilities (Campbell 1987). Within this literature two themes are particularly important: the processes which give rise to the winnowing of ideas in a pre-adaptive sense; and the limitations on the generation of possible ideas via principles of guided variation. Stein and Lipton place particular emphasis on mechanisms for pre-adaptation, those heuristics and focusing devices which shape the hypotheses that are candidates for testing. They suggest that the heuristics can be of three general types: abstract rules or general principles of inquiry; concrete rules, specific ways of generating hypotheses in a discipline context; and exemplars, canonical solutions or concrete models of solutions to specific problems.

This emphasis on diversity of innovative behaviour raises the question of whether there exists a true model of the reality of any given innovative context, or whether there are as many divergent representations as there are diverse behaviours of firms. Wilson (1990) tackled this question by distinguishing two approaches: where the generation of ideas is based on some model reality, and when it is based on what he call adaptive imaginary representations or fictional worlds which simplify complex reality and provide a set of instructions (algorithms) on how to behave in particular circumstances. He placed all models of rationality, including bounded rationality, in the first group.

However, a fictional world limits and motivates behaviour and should be judged by its operational effectiveness, not by its relation to the truth – in the scientific sense appropriate to a model of reality. Thus if models of reality are 'scientific', adaptive imaginary representations are 'technological' in that, like engineering knowledge, they are tested by their utility, accumulated by trial and error, and are the epitome of rule-guided behaviour. It seems to us that managerial ideas about what a firm is capable of are adaptive imaginary representations rather than models of reality and in this they equate to technology and engineering not science.

History matters because history shapes the knowledge which is extracted from particular items of information. Hence the reason why firms so often get it wrong in their appraisal of new technology or market opportunities is that they appraise them through a distorting mirror, the mirror of their past which in all likelihood stands ready to shatter in the face of significant innovation.

In Schumpeter's theory of innovation (1912), it will be remembered the entrepreneur is precisely distinguished by an ability to take leaps into the unknown, to break with the past, to act although ignorant of the consequences of action. Brian Arthur (1994) expresses the matter perceptively when he emphasises the resort to inductive reasoning and pattern recognition in the face of complexity. New information is evaluated by reference to previous experience; it cannot usually be evaluated by theory and this gives to the knowledge-generation process an inherently path-dependent character. This is a natural point to turn to the mental frameworks which guide our innovative imagination, and in particular to these frameworks in relation to the accumulation of technological knowledge.

The structure of the firm's knowledge

In a fundamental sense all the activities of the firm are premised upon a certain state of knowledge, which immediately suggests a connection between the capabilities perspective and the way in which recent scholars have come to view the accumulation of practical knowledge. To a substantial degree this literature is concerned with the accumulation of technological knowledge and one of its purposes is to draw out the difference between science and technology in terms of the relative lack of theory dependence of the latter and its reliance upon *practical* falsification criteria. Now the operational and strategic knowledge of the firm is in this regard similar to technological knowledge. It is dominated by questions of procedure and the appropriate tests are strikingly simple. Either the knowledge results in profitable activities or it does not; the truth of the knowledge in a scientific sense is not the issue. It is thus worthwhile to explore in more detail the nature of technological knowledge and draw the implications for capabilities. The central point about this perspective is the notion of structured knowledge and the associated constraints on the rate and direction in which new knowledge is acquired. For the firm this implies limitations on what it can do and limitations on how it can develop. Here, the idea of technological paradigms first articulated by Dosi (1982) building on Kuhn (1962) is instructive. Put succinctly, a paradigm is a structured set of concepts, facts, and the relations between them. In particular, a technological paradigm constrains the rate and direction of technological change in both positive and negative terms. That is, the paradigm influences the positive steps in certain technological directions, while avoiding steps towards other uncharted waters. It defines an opportunity set, acting as a focusing device which raises productivity in the search for technical improvement precisely because it limits the questions which are asked. The associated trajectories have an *ex post* existence as a realised pattern of technical development, and an *ex ante* existence in terms of the beliefs, expectations and intentions which shape the day-to-day activities of technologists and their managers.

The general thrust of this paradigmatic perspective is cognitive. To paraphrase Vincenti, it concerns what technologists know and how they come to know it. Such a paradigm indicates fruitful directions for technological change, defines concepts of progress, establishes tests to judge performance and has a powerful exclusion effect on the collective thinking of engineers, technologists and the organisations they represent. A technological paradigm builds cumulatively by suggesting a sequence of puzzles sometimes guided by theory but often solved entirely empirically. A progressive technology generates many performance enhancing puzzles, and in this routine aspect it is akin to normal science.

However, technological design and development is more concerned with puzzle solving than with hypothesis testing, more with verifying what works than with theoretical falsification. A technological puzzle is solved when the performance standards of an artefact are improved or become more predictable, not when a puzzle solution yields a better understanding of a natural phenomenon (Vincenti 1990). Moreover, technologies involve practice as well as knowledge, and this is why it is necessary to investigate the development of a technology in three dimensions: the growth of codified knowledge, the acquisition of tacit skills, and the development and application of product and process artefacts (Layton 1974).

What Dosi has meant, in more general terms, by technological paradigm applies also to the more focused concept of a normal design configuration (Georghiou *et al.* 1986). Indeed, a paradigm will normally have within it a range of design configurations for specific groups of closely related artefacts. The paradigm is a broad, aggregate concept, for some purposes too broad to explain effectively exactly what technologists within specific firms focus upon in their day-to-day activities. We therefore prefer the narrower concept of a design configuration which relates to a specific group of artefacts and their production process. By a normal design configuration, as applied to engineering technology, we mean the set of fundamental design concepts, i.e., 'the general shape and arrangement that are commonly agreed to best embody the operational principle', which in turn implies the understanding of how a device works, how the parts of which a device is made concur together in achieving a wanted purpose (Vincenti 1990: 208–9). These lower levels of technology define more precisely the frameworks within which engineers and technologists think. They share the general features of the paradigm, but differ significantly in important details. For example, within the paradigm of electricity generation, there were two competing design configurations, one based upon direct current and the other on alternating current. Sufficiently similar, yet sufficiently different. Likewise, the diesel and petrol engines are different design configurations within the internal combustion engine paradigm and water jet and air jet looms are different design configurations within a paradigm for weaving cloth. Betablockers have a design configuration different from calcium antagonists and ACE inhibitors within the cardiovascular

drugs paradigm. We note also that Nelson and Winter have employed the phrase *technological regime* as an equivalent to technological paradigm, comprising a collection of design configurations each one defining a specific realisation of the technology.

One further implication of the piecemeal, trial and error nature of technological development and the imperfect dependence on scientific knowledge is that the limits of any technology are often only poorly understood. Consequently, when the operation of the artefacts strays beyond the bounds of normal operation, the outcome is frequently disastrous and we have, in Constant's words, a functional failure. Such failures are not predictable in any rational sense but they certainly change the prevailing 'world' view of the relevant community of practitioners (Petroski 1994).

The closer we get to the firm the more technology is specific; the articulation process, though drawing substance from the same body of latent knowledge, leads to differentiated artefacts. Such a process generally leads to the creation of sets of artefacts characterised by differences in performance and evolving along different paths. Kuhnian scientific paradigms overlap with the concept of technological paradigms. Insights drawn from a given scientific paradigm may underpin development in a number of technological paradigms. Conversely, the development of technological paradigms poses puzzles for the underlying science so that, as a general proposition, science is stimulated by technology and stimulates technology. It is a two-way street (Rosenberg 1990).

What is important about this argument is that epistemic variations, which all developments within the firm are at some point, while they may necessarily be blind in that their economic performance can only be anticipated, are not random (Campbell 1987). The mental frameworks within which innovative ideas arise are heavily shaped by past experience and by the limits imposed by the particular sets of heuristics in play. The search for novelty cannot be random, for if it were it would fall victim to the tyranny of combinatorial explosion, there being too many possible combinations of human ideas to imagine and evaluate. If new ideas are to come, they come because search is directed to limited areas of the set of possibilities. In this sense innovations are never entirely novel, but are always prefigured in some of their dimensions.

What is true of technology, we suggest, is applicable in a broader sense to the knowledge which defines the productive opportunity of the firm in its many dimensions. Technology, in the broad sense of production and use, is, of course, a major component of that opportunity, and hence the set of productive services that the firm develops may be expected to have the features of design configurations as outlined above. But the same is true of the firm's knowledge of its markets. Hence, we suggest, what is distinctive about each firm is its particular theory of business, those interrelated concepts, facts and expectations which constitute the knowledge base of the firm. When interpreted as the firm's design configuration, they provide some interesting insights. The development of the firm's knowledge proceeds within bounds.

Variation is guided variation, as the firm is not capable of comprehending all changes in its environment. Rather, its comprehension is localised since the firm is to a considerable degree locked into its view of the world, from which escape may be very difficult. Perhaps its beliefs are its most important category of sunk capital, with all that implies for the willingness and ability to change. After all, economists would not normally consider that they could with any facility transform themselves into surgeons. Why should it be any different for specialised organisations? This is to say not that radical change does not occur within the firm, but rather that it is unusual and that it is attempted more often than it is achieved.

At this point the link with capabilities becomes clear for, as we suggest, the capabilities of any business unit are formed around its particular set of theories of business. It provides the basis for a shared view of the world and provides the lens through which that world is perceived by the firm. As with all cognitive frameworks, this permits progress by limiting progress; by illuminating some avenues of development, others are necessarily closed off, as Loasby has persuasively argued (Loasby 1991).

The capabilities approach

Having outlined relevant aspects of bounded rationality and the growth of knowledge, we turn to a knowledge-based view of the firm. The firm is defined by what it knows; its knowledge determines what it can do and how. In recent literature, this has become known as the capabilities view of the firm and it is of considerable interest in any study of the sources and conduct of innovation-related activities, for the essence of a change of capability is that it requires a change of knowledge within the firm (Kogut and Zander 1992). However, within this burgeoning literature there exists a good deal of conceptual ambiguity to which we now turn.

In the following sections, we make a number of broad distinctions which can be summarised by the statement that the market performance of the firm depends upon the combination of its capabilities with its strategic objectives or intent. That is to say, given capabilities can be deployed in a variety of ways; they are a latent basis for action. We see capabilities as Penrosian bundles of productive services, derived from resources, and articulated by routines in specific organisational contexts, formal and informal. Let us explore these concepts in more detail.

Resources

Several recent contributions to the management literature have focused upon the differences in the resources commanded by different firms. Barney (1991), for example, emphasises the importance of firm resource heterogeneity as a basis for competitive advantage and distinguishes in broad fashion between the physical, human and organisational resources of the firm. Many of these

resources can be acquired or disposed of in market transactions, and therefore cannot be a basis for differential advantage. To be the basis of differential advantage, the bundle of resources must be deployed to create differences in effectiveness and efficiency, there must be no strategic substitutes available to rivals, and the resource bundle must not easily be imitated. What is it that transforms separable marketable inputs into differentiated, unique and integrated resource bundles? The answer is the knowledge of the productive opportunity at the firm's disposal because it is this knowledge that is the key to capability. What is it that sustains the uniqueness of a particular capability? Imperfect mobility in imperfect resource markets is one reason for imperfect imitability, but more significant is the complexity of the knowledge links between particular resource bundles and competitive advantage. These give rise to observational difficulty and causal ambiguity (Dierickx and Cool 1989), as reinforced by the social complexity of the resource bundles when viewed internally, in terms of organisational structures, and externally, in terms of customer supplier linkages.

Amit and Schoemaker (1993) have explored similar themes but they emphasised the imperfect tradability of those resources, particularly knowledge, which give strategic advantages and the consequence that they must be accumulated internally. This, together with the specialised nature of the intangible assets, means that the latter are sunk and open to sudden obsolescence, and that they are a basis for inertia in responding to new opportunities. Of course, this is one of the implications of the paradigm view of knowledge – that it accumulates within boundaries and is not infinitely malleable.

It is clear from this resource-based perspective that a great deal of the competitive value of knowledge depends on matters of organisation and activity.

Organisation

Consider now the matter of organisation, the firm as a collection of skilled individuals, each with his own knowledge, aptitude and motivation, brought together in teams which are focused around activities (Penrose 1959; Richardson 1972). These activities may be grouped in different functional ways – production, research and development, marketing, etc. – but for our purposes it is useful to define them in relation to three broad groupings, concerned respectively with the operation of current activities, the growth or replication of current activities, and the development of qualitatively different operations through innovation.

Of course, any effective team is much more than simply the sum of the individuals contained within it and the knowledge and skills that they possess as individuals. First, the individuals operate with the help of other complementary productive assets (Teece 1987) and, second, the individuals are coordinated in that they work jointly on tasks. The organisation of the firm creates its distinctive signature by coordinating the internal division of labour and, equally importantly, by transforming the knowledge and skills of the individual members into a collective, unitary capability, which McKelvey (1982) has suggestively called a competence pool.

A moment's reflection on the nature of any team sport will illustrate the point perfectly, and reinforce the idea that an important management task is the effective choice of individuals and motivation and allocation to teams. The organisation is the framework for learning and creativity that further forms the context in which any new knowledge is acquired. In terms of our previous discussion, it is the framework within which the firm's distinctive adaptive imaginary representations of its world emerge. The same teams of individuals placed in different organisational context are expected to know different things, while a change in the individual members of the organisation may equally be expected to change what it knows and how it learns. Thus what individuals know and can achieve depends on their context.

In this way we like to sum up the organisation as an operator transforming the individual into the collective; it is a device for coordinating the division of labour in the generation of knowledge and skill, a device which gives the firm or business unit its individual and indissoluble character.

If one accepts this argument about organisation, one is of course in danger of underemphasising the role of the individual. This would be a mistake, since firms are composed of individuals and indeed any serious discussion of entrepreneurship emphasises that point (Hughes 1971; Douglas 1987; Millard 1990). So this line of argument is meant not to deny the importance of the individual but rather to emphasise that individuals always operate in an organisational context. However distinctive the individual may be, context is still important. Clearly, in closely coupled organisations there is far less scope for individual creative behaviour than in more open, loosely coupled organisations. It is a familiar theme in the management literature as to where one draws the balance, close coupling being beneficial for efficiency but loose coupling being beneficial for innovation and development (Loasby 1991).

Routines

The third strand of the capabilities approach is to explore the nature of the distinctive organisational resource or organisational operator in terms of its sets of decision rules or routines (Dosi and Marengo 1994). Each routine relates to some task, cognitive or physical, within a specific activity, and provides a template, the instructions for action according to the circumstances prevailing (Nelson and Winter 1982). But routines do not operate in isolation and the important point is that the firm's behaviour depends upon the interaction between its bundle of routines. Capability is something which relates to the integration and joint operation of routines. Hence it is not usually possible to link specific behaviours and competitive characteristics to single routines.

Arrow (1974) has usefully developed this idea by specifying the firm's internal language or communication code as the element which shapes the

integration of routines. Who talks to whom with what frequency on what topics and with what authority, both internally and externally, with suppliers, customers and the wider community with which the firm interacts, is a rather simple-minded way of specifying this integrative function of an organisation.

However, no organisation is simply reducible to its set of routines. For one thing, routines vary considerably in the specificity of the action they stimulate and in the nature of the information by which they are triggered. Certain routines may brook no deviation from a performance template and be entirely automatic in operation, being invoked purely by habit. Other routines may admit a great deal of interpretative flexibility so that the outcome varies with the individual or team performing the routine, and the other teams with which they interact. This is particularly likely with respect to the sets of high-level routines, such as those which guide innovative activities, since their purpose is to encourage and accommodate creativity. Equally important is the fact that routines do not denote purpose or intent, the strategic objectives of the firm.

Strategic intention

Of themselves, capabilities are inert. What brings them to life is the sense of purpose embodied in the firm's theory of business. This is a view which has been stressed by Prahalad and Hamel (1990) when they emphasise the importance of strategic intent and the failure of a resource-based perspective to account for differences in firm performance which reflect, they argue, a mismatch between resources and ambitions.

In short, productive opportunities are conjectured connections between capabilities and intentions (Loasby 1991, 1994), while capabilities are organised packages of resources and routines. The capabilities in relation to any given bundle of resources are contingent on the firm's purpose, as embodied in its theory of the business opportunity and in its theories of how to articulate that opportunity.

But capabilities are not static. They are accumulated, learnt by working with the design configuration, by exploring the opportunities that it represents. They evolve; they are joint products of the firm's activities with its proper outputs. Consequently, the relation between the knowledge of the firm and its capabilities is double-edged: on the one hand knowledge of what to do and how to do it defines capability, while on the other, the execution of a capability in the normal course of business develops the knowledge base of the firm. Hence all business units are specialised and the source of that specialisation is their design configuration. Moreover, their patterns of development arise within the localised context of a specific theory of business, each associated with its own set of practices and standard solutions to problems and each with its own external support system of users, suppliers and other practitioners within an appropriate network.

Differential and quasi-sustainable rents

One of the central themes of the capabilities literature is that differences between firms in their behaviours are a basis for generating differential and quasi-sustainable rents (Peteraf 1993). Often this is treated in a wholly static context in terms of the origins of differential earnings and the reasons they are not eliminated by market arbitrage. However, this hides a more fundamental dynamic implication of differential capabilities, namely the uses to which rents can be put to sustain and enhance competitive advantages, giving rise to the possibility of virtuous circles of firm development. This is one reason why it is important to distinguish between those capabilities which generate the current rents and those which develop that rent-earning capacity.

Much of the literature on capabilities (e.g., Dierickx and Cool 1989) emphasises a link between rent-earning capacity and the lack of tradability of the collective capability. Individuals may come and go, physical assets may be acquired or sold, but given ownership, the unitary capability is not traded. One thing this tells us is that the organisation must possess a memory, or tradition of practice embodied in its routines, so that losses in personnel can be matched with new employees who can be trained in the firm's routines. Indeed Penrose pointed out that one of the major constraints on the rate of growth of the firm is the rate at which it can absorb and train new staff of all kinds, that is to say, the rate at which they can be integrated into the capability. Thus an individual may be difficult to replace when she leaves one organisation and of much lower effectiveness when working in another organisation. The importance of context again.

Now we want to emphasise that it is with respect to the knowledge of the firm that non-tradability becomes particularly significant. For well-known reasons, markets in knowledge, be it managerial or technological, are highly imperfect and this reinforces the bias towards the growth of capability through internal accumulation. The tacitness of much of the knowledge, its indivisibility in use, the uncertainty of its values in different contexts, its proprietary nature, and the fact that much of what is known is jointly produced by the firm's activities, and indeed decays if the activity ceases, means that firm-specific capabilities cannot easily be augmented through trade and market relationships. This does not mean that the firm does not gather information from external sources. Quite the contrary, it will typically maintain a multiplicity of external sources, some arising in the normal course of trade while others reflect contractual commitments to generate new information. Rather it means that information is not knowledge and only becomes knowledge through the firm's internal transformation processes. That is to say, the transformation of information into knowledge and action depends on organisation. To repeat, this is where uniqueness of capability resides: competing firms operate in similar contexts, they receive similar flows of information, yet they know different things about their world. In short, the foundation of the capabilities perspective is the firm as a generator of differential knowledge (Teece *et al.* 1994).

Merger, acquisition and the development of capabilities

However, there is an important qualification to this argument, for collective capabilities can be traded. While they may be extremely difficult to imitate and while they may cease to function if broken into their constituent elements, nonetheless they can be traded via the purchase of the embodying business units (Teece and Pisano 1994). This provides us with new insights into the market for corporate control which is so often presented as a negative discipline on wayward managers. Instead we can see mergers and acquisitions as an integral aspect of the process of business experimentation and capability generation. Since this is a risky activity, this market also provides a route for the disposal of failed attempts to build capabilities, or, indeed, successful attempts which no longer fit with the firm's strategic intent.

Through merger and acquisition, firms seeking to build particular capabilities may obtain them more quickly through the market for corporate control. Acquisition of another firm or one of its business units may allow a firm to access capabilities that are new to that firm. It may allow the internalisation of capabilities previously accessed through external means such as collaborations or joint ventures. Equally, ownership of particular capabilities may be used to prevent competitors accessing particular capabilities, thereby allowing the exploitation of capability rents. However, from our previous discussion it will be clear that this route to capability building has its own difficulties and dangers.

From this perspective an acquisition is more than simply the transfer of ownership of a collection of physical artefacts and codified technical information. Rather, it brings together the routines and distinctive capabilities of two teams of people generated by very different managerial and organisational processes which have been built up over time in response to the unique histories of those organisations. These capabilities are deeply rooted in values and norms associated both with the firm's technological knowledge and with its goals and reasons for existence – its strategic intent (Leonard-Barton 1992; Hamel and Prahalad 1994). As we have seen, the capabilities literature emphasises the complex, context-dependent and causally ambiguous nature of capabilities and the tacit and social character of productive knowledge (Foss 1996). These characteristics of capabilities have implications when they are traded in the market for corporate control and raise interesting questions for firms about how to identify and value what is being acquired, how to integrate the capabilities of two organisations after acquisition, and how to align the acquired capabilities with the strategic intent of the new owner. We focus here on three classes of problems related to the nature of capabilities which arise during the acquisition process.

The causally ambiguous nature of capabilities

The organisation-specific, tacit and causally ambiguous aspects of capabilities and the routines that generate them have implications for the identification of

suitable acquisition targets, their valuation and the conduct of due-diligence. Much of the knowledge that underlies a firm's managerial and organisational processes is tacit knowledge of the organisation and of the complexity of the links between routines and outcomes, which for the external observer may give rise to observational difficulty and causal ambiguity (Lippman and Rumelt 1982; Dierickx and Cool 1989; Metcalfe 1996). What features of an organisation are responsible for its success and failure may be far from clear, may well not be fully understood – even by the organisation itself – and, consequently, may be rather difficult to identify and evaluate from outside. Typically one must rely on outcome measures which may indicate little about the nature and operation of the underlying capabilities. Such causal ambiguity means that the process of search and evaluation is likely to be characterised by asymmetric knowledge and uncertainty. As a consequence, a key issue for management during the acquisition process is how to manage the associated risks.

The fragility of organisational knowledge and routines

Organisational knowledge and the management and organisational processes that underpin it can be fragile and, where poorly handled, post-acquisition management can destroy the very attributes that the company has sought to acquire. If, as Foss (1996) suggests, much productive knowledge not only is tacit but is an emergent aspect of the interaction of many agents, then this has important implications for the acquisition process. In acquiring a business unit, the new owner is acquiring its routines for generating new technological knowledge. Two important points arise here that are related to the interdependencies among activities and the agents participating in those activities. First, some of these routines relate to internal knowledge generation and may be firm-specific. The business unit's relationship with other parts of the firm (for instance, the production department of another business unit within the firm) may be important to its innovative capacity, and acquisition of the single business unit rather than the whole company may cause such linkages to be lost. Second, the generation of new technological knowledge is likely to involve a class of routines related to relationships with suppliers, universities, competitor companies, professional associations and other external sources of knowledge. Linkages with external (and indeed internal) sources of technological knowledge may be informal and often specific to individuals. Such knowledge-generating routines are likely to be fragile and, at least to some degree, the loss of key individuals during the acquisition process may destroy or reduce the effectiveness of such routines. If acquisition of the target's distinctive capabilities is important, then the acquirer must seek to protect and enhance those distinctive processes if the acquisition is going to realise its potential. Where poorly handled, the post-acquisition stage can destroy the very capacity that the acquirer has sought to buy.

Differences between acquirer and target

The distinctiveness of firms raises interesting questions about how to integrate the capabilities of two organisations after acquisition and how to align the acquired capabilities with the strategic intent of the new owner. A firm's distinctive way of looking at the world represents a powerful source of inter-firm differences. This 'cognitive framework' is part of the organisation's taken-for-granted reality and may go beyond surface values to 'preconscious' and 'invisible' basic assumptions about the nature of the organisation, its innovation process and its business environment (Schein 1984; Leonard-Barton 1992). The cognitive framework is based on shared history and experience and on the accumulated decisions and events of its corporate history. As such, the distinctive identity of firms may not change easily and the bringing together of such organisations may be the source of tension and conflict after acquisition. The causally ambiguous nature of capabilities means that the relative value of firm distinctiveness may be highly contested, not least when post-acquisition changes threaten the status quo. How the acquirer and the acquired respond may depend very much upon their self-image and the value they place on retaining their distinctive identities. Clearly, if acquisition of the target's distinctive capabilities is important, then the acquirer must seek to protect the distinctiveness of the acquired organisation rather than to impose its distinctive style. This also suggests that acquisition may require changes in the routines and cognitive framework of the acquirer as well as of the acquired organisation if the acquisition is to be successful. From a capabilities perspective, the weight placed on the importance of capturing distinctive capabilities and organisation style is an important factor of the post-acquisition management approach adopted by the acquirer. In this respect, the way that a company chooses to manage the business that it has acquired reflects certain assumptions about the feasibility and desirability of combining capabilities (James 1997). All of this suggests that the way in which the integration of capabilities is approached will be the key to the outcome of a mergers situation.

Finally, it will be apparent from this discussion that the valuation of marketable business units is a non-trivial task. Granting for the sake of argument that the capital market is efficient, it still only follows that all that is valued is the income stream associated with the current managerial team. The capability is not valued directly and so it is not difficult to see the relevance of the literature which identifies a presumption of poor post-acquisition performance, a presumption that only the target shareholders will gain, and a presumption that targets will be overpriced (Gaughan 1994). The valuation of targets is a matter of judgement, judgement which may be more seriously flawed the more dissimilar are the capabilities and theories of business of the two firms, and the less the acquirer factors into its calculations the possible costs of integrating the two sets of capabilities.

Given an efficient market, it is obvious that the purchase of a target will result in its rents being translated into capital costs for the acquiring firm.

Hence, rent-generating capacity can only be sustained if the acquirer believes it can improve the target's capabilities over and above those of the existing management. Thus, the root cause of mergers and acquisitions is to be found in beliefs that the capabilities of the acquirer can improve the capabilities of the target or establish new capabilities for the joint enterprise to an extent which is not public knowledge. Once again we see the significance of tacitness, complexity and causal ambiguity.

Concluding remarks

Where does this discussion fit? We have argued that the capabilities perspective on the firm is distinguished by its relation to the dynamics of knowledge accumulation in market economies. From this foundation it can make important contributions to the theory of economic growth, to the theory of competition and competitive advantage, and to the theory and practice of innovation policy. In respect to this latter point we believe that it is important to recognise that capabilities are not developed solely in isolation, but depend on the firm's interaction with the wider world of which mergers and acquisitions provide one important example. However, the deeper significance of this approach lies in its bearing upon the evolutionary dynamics of economic change. Economic evolution depends upon the continued generation of novelty and thus upon the continued development of the capabilities of firms and the effective selection of the differences between firms by market processes. It is here that the capabilities approach has so much to offer in helping to understand how firms come to be different and how those differences are developed differently through time. How capabilities matter thus depends on the selective properties of markets and, as we claimed at the outset, markets and firms are complements, not substitutes.

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4 Synthesising resource-based, evolutionary and neoclassical thought

Resource-advantage theory as a general theory of competition

Shelby D. Hunt

Introduction

Consider the two versions of the contractual theory of the firm. In the nexus of contracts view, one finds maximising managers who face moral hazard. Therefore, firms result from the incentive problems that arise when team-production is combined with opportunism (Jensen and Meckling 1976). In the incomplete contracting view, one finds boundedly rational managers who face opportunism. Therefore, firms arise from efforts to secure the rents that flow from transaction-specific assets (e.g., Williamson 1985). As Foss (1993) points out, however, both contractual perspectives imply a static analysis in which 'technology – as well as the menu of inputs and outputs more generally – is given through some process that is historically and logically prior to the issue of the organisation of economic activities' (p. 131). Indeed, he notes that taking the transaction as the analytical unit and viewing 'the firm' as nothing more than shorthand for a set of contracts among transacting individuals result in the *firm's* strategy as a meaningless concept and 'it comes as no big surprise that . . . nexus of contracts theorists . . . call for the abandonment of the concepts of "the entrepreneur" and "the firm", respectively' (p. 130).

In contrast, Foss (1993) argues for an evolutionary, competence perspective, which views the firm as a repository of tacit knowledge. Associated with the works of Demsetz (1988), Klein (1988), Langlois (1986) and Prahalad and Hamel (1990), Foss (1993) traces the competence perspective to the long-neglected work of Penrose (1959). She not only maintained that firms are pools of intangible resources but, with prescience, pointed out: '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' (Penrose 1959: 15). Building on Penrose's (1959) seminal work, Carlsson and Eliasson (1991), Eliasson (1990a, 1990b), and Pelikan (1988, 1989a, 1989b) have developed the competence perspective. Following Pelikan's (1989b) treatment, Foss (1993: 134) characterises the epistemic and economic content of the concept of competence: