The current issue and full text archive of this journal is available at
www.emeraldinsight.com/0025-1747.htm

SECTION 6. KNOWLEDGE

Knowledge as a lens on the jigsaw puzzle of strategy

Reflections and conjectures on the contribution of a knowledge-based view to analytic models of strategic management

John McGee and Howard Thomas
Warwick Business School, Coventry, UK

Abstract

Purpose – The purpose of this paper is to demonstrate how to incorporate knowledge concepts into analytical models of strategy formulation and the strategic theory of the firm.

Design/methodology/approach – The paper examines four different perspectives of the elusive concept of "knowledge", namely, "knowledge as assets", "knowledge through innovation", "knowledge embedded in routines" and "knowledge through learning". The study attempts to specify and interrelate the concepts of a knowledge-based strategic theory of the firm.

Findings – The "knowledge web" is seen as a partial framework, capturing from a strategic perspective how both specific and organisational knowledge build the competences necessary for the value-creating activities of the firm.

Practical implications – The paper provides frameworks for understanding how knowledge can reinforce the strategic core competences of the firm.

Originality/value – The paper addresses knowledge as a key element in the development of an enhanced strategic theory of the firm, incorporating the knowledge-based viewpoint.

Keywords Competences, Competitive strategy, Knowledge management, Resources, Corporate strategy

Paper type Conceptual paper

1. Introduction

There is increasing interest in the nature of "knowledge" in the field of strategic management (Spender, 1996). In information management, the burgeoning areas of intellectual capital (Pike *et al.*, 2006), knowledge management (Nonaka and Takeuchi, 1995) and organisational learning (De Geus, 1988; Senge, 1990) examine the role of knowledge in the enactment of strategy. New preoccupations of economists with organisational economics, and emergence of the resource-based (Wernerfelt, 1984) – and, perhaps, knowledge-based (Eisenhardt and Santos (2001) – view in strategic management provide alternative lenses for exploring how knowledge links to strategy development. This raises questions such as: "Is 'knowledge' a variable that can be operationalised in our theory making and hypothesis testing, or is it, like the economist Robert Solow's famous articulation of 'technical change', a residual that soaks up huge amounts of variance without offering greater depth of understanding?"; and "Is knowledge better framed in asset terms involving such key strategic assets as intellectual capital (Amit and Schoemaker, 1993) or is it better captured in a dynamic framework where learning is the variable of interest?"

Management Decision
Vol. 45 No. 3, 2007
pp. 539-563

0025-1747
DOI 10.1108/00251740710745124

In responding to its acknowledged heritage from economics and the theory of the firm strategic management has created a rod for its own back by claiming that its purpose is to explain the performance differences between firms. But there has been little progress in achieving this in much the same way as successful specification and estimation of performance models has eluded economists. In our viewpoint, strategy is generally concerned with varieties of firm-specific imperfections where contexts are highly idiosyncratic, and causal ambiguity often prevails. Accordingly it is not surprising that quantitative explanations of differential performance are elusive. In the same vein it is equally unsurprising that some progress has been made in advancing theories of behaviour that contribute to parts of the strategy picture, e.g. the positioning (market-based) view (MBV) and the resource-based view (RBV). These have been judged by their a priori validity and by their power to explain parts of the behaviour of firms – hence they are partial models. We think that a knowledge-based view (KBV) might follow this (useful) approach in providing an enhancement of existing partial models and in doing so might enable us to add some more connected pieces to solve the jigsaw puzzle that is the essence of strategy in a complex environment. Therefore, the primary purpose of the paper is to demonstrate how to incorporate knowledge concepts into the analytical models of strategy formulation and the strategic theory of the firm.

2. Knowledge, strategy formulation and the strategic theory of the firm

The argument of this paper addresses four different perspectives on knowledge from an economic and analytic viewpoint: knowledge as assets for protection, knowledge through innovation, knowledge embedded in routines, and knowledge through learning. Finally we set up criteria to judge the arrival of an emerging, integrative, KBV of strategy seen from an analytic, theoretical viewpoint, not from the more practical perspective of knowledge management and the "enactment" of strategy.

We begin with some important underpinnings from an economics perspective. "Boundaries" are central to an understanding of any theory of the firm. The key economic mechanism (going back to Adam Smith) is that the size of the market drives the degree of (knowledge) specialisation which itself then determines the extent of the horizontal and vertical boundaries through the effect on economies of scale and scope, and on the nature of transactions costs (Williamson, 1981) and the contractual and other costs of using markets. The traditional, comparative statics, positioning model (Porter, 1980) treats knowledge as implicit – neither explicit nor decisive in its contribution to analysing competition. The need for "sustainability" opens up the static model to a dynamic view. The RBV (Penrose, 1959) provides the stickiness, embeddedness, tacit, path dependent characteristics of knowledge as a differentiating and defensible resource.

This takes us into our first knowledge theme – "knowledge as asset" thinking – the search for inimitable distinctive assets or core competences. However, this only goes so far as to characterise "knowledge as protection" for competitive position. We then appeal to Schumpeterian ideas (Christensen, 1997; Hamel, 2000) and to the literature on innovation to see – critically – how expansion of the frontiers of knowledge serves as the genesis of advantage, "knowledge as innovation". The economic rationale concerns the nature and effect of the incentives to innovate. From a strategy perspective we are interested in the consequences of innovation for different types of firms, small versus

large, incumbents versus entrants, and for the impact on industry structure. Evolutionary economics brings an organisational lens through a mixture of Darwinian natural selection together with adaptive feedback mechanisms (Vronen, 1995). This leads to an organisational perspective in the form of organisational routines (see the seminal work by Nelson and Winter (1982)) – through mechanisms of knowledge embeddedness plus a learning perspective. This is a dynamic perspective on routines sometimes described as organisational genetics (Vronen, 1995, pp. 74-8) – "knowledge embedded in organisational routines". Dynamic capabilities thinking (Teece *et al.*, 1997) adds learning to the RBV approach and emphasises the central role of dynamic efficiency – "knowledge as learning".

We then set up the criteria for an effective KBV of the firm and comment on the well-known papers by Grant (1996) and Spender (1996). Our first conclusion is that we are (surprisingly) quite far along in specifying and inter-relating the concepts of a KBV, and can thus offer a reinterpretation of the field in terms of "strategy as knowledge". The nub of this argument is that a KBV impacts directly on all aspects of strategy – the interconnectedness of knowledge acts not just as a metaphor for strategy but as a meta-level analysis of strategy, i.e. the glue that binds different forms of strategic thinking together. Second, however, since knowledge is an abstract concept (Spender, 1996) – an intellectual construct – and is rarely observable directly, the empirical record is currently quite patchy. This, therefore, positions the KBV as intuitively appealing conceptually but empirically elusive (in fact very typical of strategic management generally). Third, we offer final observations on the further development of the KBV.

3. The economics of the firm and the theory of competitive advantage

We begin with an important review of the theory of the firm and a competitive advantage from an analytical and economic perspective. This review sets the framework for the examination of the KBV from the viewpoint of the theory of the firm (see also McGee *et al.*, 2005).

The well-known shapers of the horizontal (product range and market segment) boundaries of the firm are economies of scale and economies of (narrow) scope[1] (Chandler, 1990; Teece, 1980). The central economic concept is "specialisation" driven by scale and scope where specialisation occurs as a function of market size[2]. This is a prime link between the market and specialisation within the firm and is the driver for recent fascination with deconstruction among consulting firms (Evans and Wurster, 1997, 1999).

The logic of vertical integration rests on the economics of "make versus buy" coupled with transactions cost economics, especially the Williamsonian (Williamson, 1981) notion of "economising" (essentially a mixture of technical efficiency and agency efficiency). The rush towards cooperative strategies suggests that firms think the agency problems are soluble – hence the fascination with the "virtual corporation" and the Boston Consulting Group (BCG) "Blown to Bits" examples of deconstruction and orchestration (Evans and Wurster, 1997, 1999). These are powerful economic mechanisms: the argument is that knowledge (driven by expansion and economic growth) is a fundamental driver of specialisation and of the balancing act between technical and agency costs. The rationale for the horizontally and vertically extended company rests on the tacit knowledge that allows internal coordination to be less costly

than external contracting through markets. However, the contemporary, running argument is that the increasing size of global markets permits greater knowledge specialisation that in turn shifts the balance between the firm's valuation of internal tacit knowledge and externally held explicit knowledge.

Figure 1 is an example of disintermediation through outsourcing. The rate of expansion of large, global markets allows for new knowledge specialisation opportunities. These allow for the arrival of new firms that convert tacit, coordinative corporate knowledge ("corporate glue") into explicit, codified, and saleable knowledge-based products. This changes the balance from internal co-ordination to external market contracting and – taken as a trend – leads simply to outsourcing and more generally to disintermediation. Note how common standards and interfaces allow pieces of knowledge to be snapped together like LEGO thus reducing internal co-ordination costs.

As outsourcing proceeds and individual islands of corporate tacit knowledge are dismantled what happens to competitive advantage and to entry barriers? The reduction of barriers based on tacit knowledge places more burdens on explicit knowledge assets and on the assets that underpin cost-based strategies. The ability to control the supply chain is known as "orchestration" by Evans and Wurster (1997, 1999) and by McGee (2003). Orchestration enables one or a few firms to determine the standards and operating rules by which a supply chain operates. In effect the smaller, "orchestrated" firms adopt the standards set by the orchestrators, the owners of the competitive advantages. For example, Microsoft and Intel through the Wintel standard orchestrate the personal computer supply chain. Firms such as Unilever and Procter and Gamble seek to orchestrate their supply chains through strong brand names supported by product development. The effect of deconstruction is to open up the market to new firms and to create the possibilities of newly orchestrated forms of advantage.

This is the traditional heart of strategy – the analysis of markets and the structure of industries (Porter, 1980, 1982). It is, however, an industry level of analysis showing how profits arise from imperfections using competitive advantage as the intermediating construct. We call this the MBV. In this MBV knowledge is largely implicit being either tacit in nature or captured in terms of its effects (such as patents)

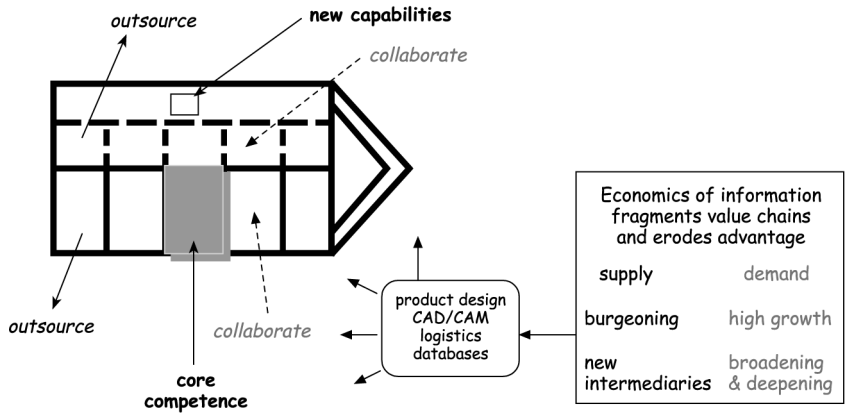

Figure 1.
Disintermediation

rather than in its resource characteristics. Thus, knowledge is reflected in differential positioning and in a knowledge production function whose inputs are simply cash and whose outputs are characterised in economic terms.

There are two useful amendments to this view. An early addition was the use of game theory in situations where advantages were held to be weak or transient and competition was oligopolistic. Advantage might be gained by out-strategising the opponent following game theoretic principles. Of interest to us are those situations where uncertainty prevails and the value of information becomes essential for the analysis. Much later came the co-operative model advanced by Brandenburger and Nalebuff (1995) – co-opetition. Their approach is to conduct a co-operation analysis on the Five Forces, calling it the value net. Under this approach complementarities can be exploited through a co-operative mode – but it does require the existence of distinctive sets of assets protected by barriers in some way.

Figure 2 is a simple schematic to show how the MBV concentrates on product market choices leaving the internals of the firm to a mysterious but highly efficient maximisation process based on an ability to shop the world for the relevant factors of production. Note that there is no resource language here.

The traditional economic approach, therefore, treats knowledge as an implicit argument albeit an important one. Knowledge affects the nature of the economic equilibrium, like so many other variables, but does not feature as a central player with regularity of effects on the competitive outcome. As we move towards placing knowledge at the centre of strategy theory we argue that there are four distinct approaches (perhaps theories) of how knowledge works. The first is the RBV that provides us with the "knowledge as asset" metaphor. A second view is Schumpeterian (Schumpeter, 1934) in origin picturing knowledge as innovation and as an essential element in the general theme of creative destruction. Third, evolutionary economics[3] moves us away from a decision orientation towards a focus on internal organisation and the role of organisational routines. The use of a Darwinian natural selection process coupled with adaptive feedback mechanisms explains the nature of organisational routines in large organisations. Such routines and their adaptation over time require embedded knowledge, acquisition of knowledge, and transfer and integration of knowledge within organisations. Finally, the Teece *et al.* (1997) approach to dynamic capabilities adds the elements of learning and other dynamics to the RBV and suggests paths by which both RBV and evolutionary approaches can take place in practice. The progenitors of these approaches did not place knowledge per se at the centre of their writing so to a large degree what follows is a reinterpretation of existing theory in terms of a knowledge perspective.

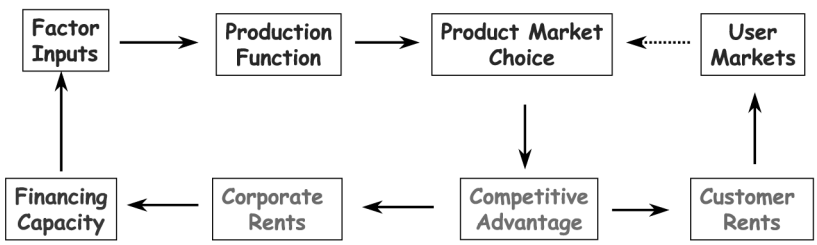

Figure 2.
Market-based view

4. Knowledge as assets

Figure 3 restates the MBV shown in Figure 2 in resource-based terms. The internals of the firm are now fleshed out in terms of resources and capabilities, the conventional description that permits discrimination between assets based on knowing and skills based on experience and actions. We do not summarise the key tenets of the RBV here. They are familiar enough (see Wernerfelt, 1984; Barney, 1991; Grant, 1991). Instead we suggest some conclusions in the language of "core competences" (Prahalad and Hamel, 1990; Hamel and Prahalad, 1993; McGee *et al.*, 2005).

First, core competences can have a very significant impact by their effect on scope (boundaries), and by the (long) time scales over which they exist and change. They arise typically through collective learning – very much in the economics tradition of "objectified knowledge" (Spender, 1996). Also, their impact is to create a meta-level on which we can view competition. At the meta-level competition is about contests for the acquisition of distinctive skills, in which competition in product markets is a "superficial expression" of the more fundamental competition over competences. Therefore the dynamics of the strategic theory of the firm focus on learning because it is logically prior to product market evolution.

Figure 4 is a simple expansion of the range and nature of asset positions[4]. The broad categories give some idea of the differing demands on internal processes and on the challenge for integration of these different positions through some form of corporate glue. Many authors have provided classifications and explanations of the language of resources, assets, capabilities and competences. A common terminology has not emerged although much of the commentary has been illuminating. Grant (1991), for example, distinguishes between resources as inputs and capabilities as those intermediate processes derived within the production function that are the main source of competitive advantage. Both are hard to define objectively and indeed Grant (1991) goes as far as to say that capabilities are organisational routines. Amit and Schoemaker (1993) also deploy the language of resources and capabilities but seek to draw links with the industry analysis framework. Resources for them are intermediate goods (in contrast to Grant), and capabilities are "based on developing, caring, and exchanging information through the firm's human capital". They are built by combining physical, human, and technological resources at the corporate level.

The link with industry (or product-market) arises when certain resources and capabilities become the prime determinant of economic rents. This can only occur if these resources and capabilities are subject to market failure and their possession can therefore be firm-specific. Amit and Schoemaker (1993) refer to these as "strategic

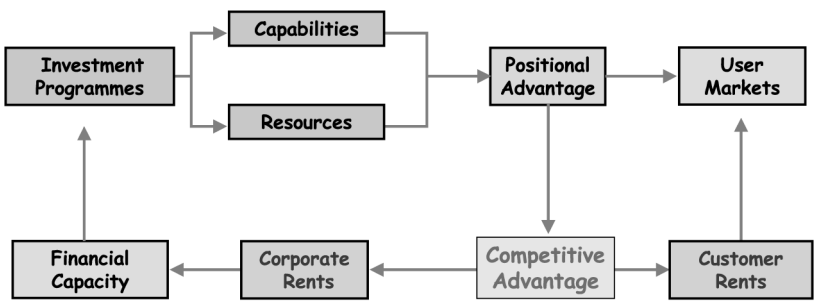

Figure 3.
Resource-based view

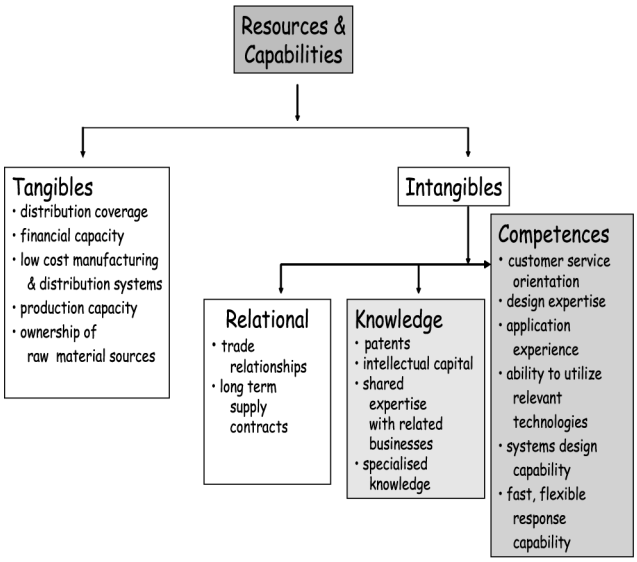

Figure 4.
Resource positions (expanded)

assets". This enables a distinction to be drawn between those resources and capabilities that are generally attainable and those that are asymmetrically distributed between firms, and difficult to trade and imitate. Prahalad and Hamel (1990) have made famous the language of core competence and avoid using the language of resources and capabilities. For them "*c*ore competences are the collective learning in the organisation, especially how to co-ordinate diverse production skills and integrate multiple streams technologies". Just as Amit and Schoemaker (1993) extend their notion of strategic assets towards product markets with a concept of strategic industry factors, so also do Prahalad and Hamel (1990) in making core competences the foundation for core products. For them the insight is not what is a core competence and how to build one, but a view of the strategic architecture of the firm by which they mean "a road map of the future that identifies which core competences to build and their constituent technologies". For these and other authors writing in the same vein, the common characteristic is the appeal to economic reasoning in the form of asymmetric distribution of assets to support economic rents. But the mainspring of firm-specific resources can lie anywhere between inputs and outputs with alternative scenarios about the contributory roles of organisation structure and process, and managerial culture. All these arguments can be criticised as lacking quantifiability.

Our own approach in Figure 4 is more modest in intent. We seek only to distinguish between some categories of resources and capabilities so that we can see different roles that knowledge can play. The distinction between tangibles and intangibles comes prior to any distinction between resources and capabilities. We divide intangibles into three parts. The first is those assets that are relational in character and mediate the relationship of the organisation with the outside world. The second is more explicitly concerned with knowledge and know-how and includes such intellectual capital themes as patents, trademarks, copyright and registered designs. Although some entries under this heading suggest explicit knowledge (such as patents) they are

surrounded by or produced by know-how that is essentially tacit. Our term competences can be used interchangeably with capabilities without any loss of meaning. These are, following Grant, intermediate processes some of which are explicit in their design but many are likely to display characteristics of organisational routines. Indeed, McGee *et al.* (2005) point out that Sony's core competence in miniaturisation allows it to make everything from the Sony Walkman to digital cameras. In the same vein, Honda's core competence in engines allows it to offer lawnmowers, motorcycles and passenger cars.

5. Knowledge as innovation

Thus, the RBV framing "knowledge as assets'provides a theory of protection and sustainability. For an understanding of the genesis of advantage we have to turn elsewhere. The Schumpeterian approach (Christensen, 1997) offers innovation as the medium through which creative destruction takes place. The element of destruction depicts intuitively and vividly but also convincingly how the old is replaced by the new. But it also sets these mechanisms in waves and floods of change suggesting that the benefits of change and innovation are overwhelmed by the magnitude of the opportunities on offer. Thus Schumpeter suggested there were patterns of change and ferment interspersed with stability. In this way Schumpeter emphasised dynamic efficiency above static efficiency. Some recent writings clearly have their origins in Schumpeter. See for example, d'Aveni's (1994) approach to hypercompetition where he argues that the sources of competitive advantage are being created and destroyed at an increasingly rapid rate. Hamel and Prahalad (1993) use the language of dominance to assert a doctrine of strategic intent and define the gap between ambition and resources as strategic stretch. But the Schumpeterian world of enormous opportunity is not the only context for innovation. Firms may wish to create their own shocks or, more modestly, may seek to calculate finer pieces of sustainable advantage.

But who innovates? Economists such as Kenneth Arrow have formulated models to explain whether new entrants have advantages over incumbents, whether monopoly can innovate more readily than competitive markets, and whether potential entrants can outwit monopolists. Of course, the answers depend on the situation but the above effects provide us with good reason for thinking that incomers may often provide the wellspring of innovation – eventually. The behaviour to be explained is not that of the innovator who rationally examines the balance between costs and revenues in the light of prevailing competition and makes innovations when the return-risk ratio looks promising. The more difficult behaviour to explain is the reluctance of incumbents to refrain from innovating in the light of expected innovation from new entrants. The two rational economic reasons for this are the sunk-cost effect and the replacement effect. The former arises when the incumbent assesses his existing technology by comparing his contribution margin to no new costs of investment beyond that of simple replacement. By contrast a new technology has a stiffer hurdle because the contribution margin (assuming for simplicity the same revenue stream from both technologies) has to cover new investment as well (see Besanko *et al.*, 2000, pp. 488-9). The replacement effect was first formulated by Arrow (1962) in considering who has the greater propensity to invest, the monopolist or the new entrant. The incentive for the monopolist to invest in a radical new technology requires a comparison of the new stream of monopoly profits with the existing stream. However, for the new entrant

who, if successful, will become the new monopolist, the incentive is simply the new stream of monopoly profits. Through innovation an entrant can replace a monopolist but a monopolist can only replace himself, hence this is called the replacement effect. Thus established firms under this thinking are less willing to stretch themselves to innovate.

However, where the monopolist anticipates that new entry is likely then the incentives reverse to favour the monopolist. The incentive for the monopolist to innovate in the teeth of potential competitive intrusion is that of retaining monopoly profits from successful innovation versus sharing the market with a new entrant as a duopoly within which prices will be lower due to competition. This is greater than that of the new entrant who expecting the monopolist to defend by innovation can only anticipate the profit streams from sharing a competitive duopoly. Arrow called this the efficiency effect. The balance between these three effects depends on the probability of successful innovation by potential entrants. Where this is low the sunk cost and replacement cost effects will dominate and the monopolists will prefer to maintain their existing cash flows. Where the probability is high then the efficiency motives will dominate and monopolists will seek to maintain their market position even if it is less favourable in absolute terms.

This analysis of innovation competition focuses on the payoffs to innovation. There is also a literature on the choosing the right levels of research and development (R&D) under market uncertainty and under uncertainty about the response of rivals. The analysis of first-mover advantage is well known. It asserts that the first mover gains advantage by establishing explicit knowledge protected by patents and trademarks and goes on to build advantages of scale, experience and scope so that later movers can never erode the early advantage (see Ghemawat's (1991) description of Du Pont in titanium chloride). There is also an interesting empirical literature on technology races and patent races (Gottinger, 2003). These races describe the battles between firms to complete a successful R&D programme and to be the first to market with an innovation with all the benefits of first mover advantage. A race is an interactive pattern of competition characterised by firms constantly trying to get ahead of their rivals, or trying not to fall too far behind. Like the dominant design literature (Anderson and Tushman, 1990), racing behaviour is also a dynamic story of how technology unfolds in an industry recognising the fundamental importance of strategic interactions between competing firms. A simple race between two firms might involve the following. The leader may consider further investment to outdistance its rival and get to the winning post first. But it is aware of the diminishing marginal productivity of research for itself and the uncertainty of innovation for its rival. It therefore has to balance the risks and expenditures associated with pressing on with the benefits of delay in terms of consolidating its own knowledge and the difficulty for its rival of catching up. By contrast the follower is faced with the need to catch up, but has the same concerns about the productivity of research offset to some degree by at least some knowledge about the successful path followed by its rival. The leader has considerable incentives to be cautious whereas the follower might be more inclined to plunge ahead. Clearly the variables are many and imponderable given the uncertainty of success in R&D and the difficulty of predicting the responses of rivals. Gottinger (2003, pp. 37-8) summarises the implications:

At one level, racing behaviour has implications for understanding technology strategy at the level of the individual firm and for understanding the impact of policies that aim to spur technological innovation. At another level, racing behaviour embodies both traditions that previous writings have attempted to synthesise: the "demand-pull" side emphasised by economic theorist and the "technology-push" emphasised by the autonomous technological innovation school.

Gottinger (2003, p. 51) observes from his research on telecommunications and computer industries the apparent inability of technology-oriented companies to maintain leadership in fields that they pioneered. These failures might be due to agency problems or other sub-optimal managerial behaviour. But of more interest to our thesis here is the existence of market asymmetries that affect racing behaviour: risk- and resource-driven asymmetries. The latter are clearly linked to the replacement effect (above). All this literature (Abramowitz, 1986, Gottinger, 1998, 2001; Lerner, 1997, Scherer, 1991) carries implications for knowledge in terms of its creation, how it is accessed, transferred and integrated, and who has the incentives for these activities. This suggests the need to examine organisational processes and the routines that shape its future orientation.

6. Knowledge embedded in routines

Recently the strategy literature has paid attention to the organisational processes that form the basis for the development of the firm's strategy (Teece *et al.*, 1997; Johnson and Huff, 1998, Eisenhardt and Martin, 2000). These scholars, along with others, focus on the routines[5], competences and capabilities of the firm that shape its development in the long run. This approach shifts the focus of attention from the market positioning view (described earlier) to a more micro analytic approach that aims to go even deeper than the RBV, aiming to understand the way in which competitive advantage is actually developed (Johnson and Bowman, 1999). Our interest here is in the routinised elements of strategy making. This is well grounded in the literature (March and Simon, 1958; Nelson and Winter, 1982; Cyert and March, 1963; Teece *et al.*, 1997).

Less well known and certainly less commonly cited alongside the above scholars is the long-standing preoccupation of economists with evolution[6]. Veblen (1898, p. 397) talks about "the process of cumulative change". Marshall (1920, p. xiv) used the term "economic biology" and argued that the "the key-note is that of dynamics rather than statics". These represent early arguments about economic evolution. Although economists have spent considerable time developing the neo-classical theory of the firm (a misnomer for a theory of markets), the notion of "evolutionary economics" has gained considerable momentum. Some of the impetus for this derived from the long controversies about "marginalism"[7]. This led to the breaking open of the black box of the firm and the onset of the new theory of the firm.

The essence of this is to throw light on the internal organisation of the firm. Whereas the traditional theory is concerned with prices and output, the new theory is interested in how transactions are organised. The intellectual progress of this strand of economics is marked by Coase's (1937, 1988) path-breaking paper on the nature of the firm, new approaches to understanding the nature of ownership bringing inn property rights (Alchian and Demsetz, 1972) and agency costs (Jensen and Meckling, 1976), and Williamson's (1985, 1987) transaction cost economics. Coase (1937, 1988) anticipated all of this in pointing out that the essential differentiating feature of intrafirm

transactions, as opposed to interfirm transactions, is authority and hierarchy. This stream of thinking does reinforce the idea of "efficiency management" – Williamson (1981) expressed it as the strategy of "economising", and this has strong resonance with the idea of cost minimisation from neo-classical theory. But more important than this it opens the door to ideas about the evolution of efficient organisational forms. Vronen (1995, p. 2) maintains that evolutionary economics is inspired by the new institutional economics. This analyses processes through which institutions evolve (Langlois, 1986). Similarly the sociologist Granovetter (1985, p. 488) argues that:

> [. . .] social institutions and arrangements previously thought to be the adventitious result of legal, historical, social or political forces are better viewed as the efficient solution to certain economic problems.

The central part of evolutionary theory is the selection argument that argues that competitive markets select for the most efficient organisational forms. Although there are considerable debates about the precise forms and implications of this process, the selection argument is the hard core of evolutionary theory. Evolution is a form of organisational ecology where firms engage in behaviour that is routine rather than purposive. Adaptation takes place by mimicking the survivors who are accidentally well adapted. Managers get little credit in this view. Scholars like James Brian Quinn have argued for processes that are typically fragmented, evolutionary and intuitive. He describes this as logical incrementalism (Quinn, 1978) in which minor changes in strategy take place as a response to changes in the external environment in an evolutionary and adaptive manner.

Nelson and Winter's (1982) approach (drawing heavily on Winter (1964)) is a sustained argument that selection is not an *ad hoc* or involuntary response, but is systematic and purposeful firm behaviour. They – famously – argued for collections of routines based on tacit knowledge supplemented by organised search behaviour for modifications or substitutes. This allowed for the evolution of economic thinking (over many decades) to map onto the newer thinking from management theorists attempting to understand and map organisational processes. The essential link is purposive behaviour of managers and we shall argue that this is characterised by asset and knowledge accumulation and by learning processes that allow knowledge to be transformed from tacit to explicit. Thus we see Burgelman (1983) arguing that the intellectual basis for activist and explicit roles for top managers is based on complex organisations that are subject to both evolutionary and planned processes.

Nelson and Winter (1982) introduced us to evolutionary economics but much is owed to Simon (1955, 1959, the concept of satisfying and bounded rationality) and Penrose (1959 (theory of the growth of the firm)). Although Nelson and Winter's (1982) tone is somewhat hostile to traditional economics, their approach can be seen as a rehabilitation of the theory of the firm by providing (far more) realistic assumptions but in the process not disturbing the orthodox neo-classical conclusions (although some may argue this point). They shift attention away from decision calculus (how can one continually make these complex trade-offs about everything?) to internal organisation where organisational routines regularly and automatically make "decisions" based on the knowledge and best practice embedded in those routines. The argument for routines that make "good decisions" is based on two points: one, a Darwinian natural selection process at an organisational level that ensures that only

the "best" routines are kept in operation, and two, on an adaptive feedback mechanism at the individual level that permits new knowledge to be accessed and then diffused through the organisation to be eventually embedded in routines. Routines are thus embodiments of organisational memory – better called organisational genetics.

The evolutionary approach is saved from ecological sterility by the learning process (based on Simon). Through this we can see the essential elements and characteristics of a KBV starting to take shape: tacit versus explicit knowledge; relative roles of individuals, groups and organisations; sourcing and accessing of knowledge, transfer and integration of knowledge (note the classic formulation by Nonaka and Takeuchi (1995)).

7. Knowledge as learning

Nelson and Winter's second set of routines are those that determine the long run changes in the firm's stock of capital – hence they are called strategising routines. Attention has been paid to the contribution of planning and budgeting processes to the accumulation of fixed assets over time. But more central to our argument are the product and technology development processes. For example Henderson and Clark (1990, p. 15) developed the concept of "architectural knowledge" explaining how the dominant organisational design "incorporates a range of choices about the design that are not revisited in every subsequent design". They go on to link this architectural knowledge to the development of innovation processes.

These strategising routines contribute to strategy and strategy making as they store the firm's experience in such a way that it can use it in a new context. They channel the structure of decision-making processes into the type of behaviour that has brought success in the past. However, such routines have a negative side. Over time as the environment changes new forms of organisation become appropriate and gaps emerge between environmental requirements and existing capabilities. These gaps cause routines to become dysfunctional (Teece *et al.*, 1997, Leonard-Barton, 1992) and inhibit future development of the firm (Levitt and March, 1988; Henderson and Clark, 1990; Leonard-Barton, 1992; Teece *et al.*, 1997). This leads to the processes by which routines are modified over time, organisational learning.

The literature makes many references to types of organisational learning. Cyert and March's (1963) view of organisations as complex adaptive systems suggest modes of learning. Levitt and March (1988) refer to change processes at several nested levels. Cohen and Baclayan (1994) illustrate the role of experimental learning. Bettis and Prahalad (1995) suggest that firms unlearn ineffective routines. Hedberg (1981, p. 18) suggests that unlearning is "a process through which learners discard knowledge". All of these notions build on the idea that routines flow from history and serve as the organisational memory in which knowledge about best practice is stored. The propositions about learning fall into two camps. The cognitivists (Huff, 1994; Porac *et al.*, 1989) focus on learning at the individual level and individual mental maps. Structuralists suggest that learning is an organisational phenomenon based on the firm's routines and that these are subject to formal change processes. Nonaka and Takeuchi (1995) combine these two views into their knowledge creation spiral. This begins with a distinction between tacit and explicit knowledge and maps how tacit knowledge starts with the individual and proceeds through socialisation and integration processes so that knowledge becomes a key ingredient in the organisation's

capital stock. More generally, such learning can be described as a "sense-making" process (Weick, 1979, 1995) through which the members of the organisation construct a "common reality" that influences the way they seek to achieve an "objective economic reality".

Teece *et al.* (1997) in their well-known paper on dynamic capabilities may have intended to add primarily to the RBV but they also provide a sense of the internal mechanisms by which learning and adaptation may actually take place. Their definition of dynamic capabilities is "the sub-set of the competences and capabilities which allow the firm to create new products and processes and respond to changing market circumstances" (Teece *et al.*, 1997, p. 270). In some ways this is a restatement of Nelson and Winter's (1982) strategising routines, but inherent in their discussion is recognition of learning. They identify three characteristics that permit learning. The first is the nature of the internal processes: co-ordination/integration (a static notion), learning (dynamic), and reconfiguration (a renewal or transformational concept). Second, they are specific about the variety of resource positions that might need to be addressed. Finally, they pay attention to the paths by which developments can take place. It has to be said that these concepts can be very slippery. Path dependency, for example, is celebrated only as an idea. However, they are on more firm ground in outlining the ways in which technological opportunity can shape the future. The hints they provide on the nature of increasing returns are suggested here.

We revisit our schematic again in the form of Figure 5. This time the resource side is further elaborated by the inclusion of learning and dynamics. Note, however, that the resource (knowledge) element defies construction in linear form – we begin here to see it as an interconnected whole (via the multiple arrows). Learning, moreover, creates multiple feedback effects.

8. Towards a KBV

We have reviewed four different perspectives on knowledge in strategy and in strategy making: knowledge as assets for protection, knowledge through innovation, knowledge embedded in routines, and knowledge through learning. In doing this we have touched on a wide variety of themes in strategic management, competitive

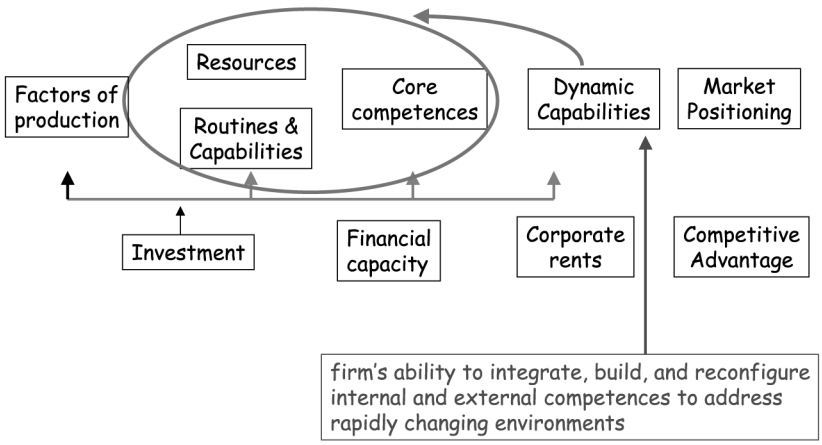

Figure 5.
Dynamic capabilities view

advantage, the RBV, strategy making, and strategising routines. We have also commented on developments in economic thinking ranging from neo-classical theory, through Schumpeter to evolutionary economics with a hint also of institutional economics. In doing this we have progressed from market positioning and the firm as a black box to serious consideration of internal organisation and those processes that underpin competitive advantage. Knowledge makes its entry as an asset, albeit largely invisible, that protects competitive position. But we have moved to a more subtle position where knowledge is embedded in individuals and by complex processes is socialised and reintegrated into the organisation at large. Do these various perspectives on knowledge enable us to articulate a KBV of strategy whose implications allow us to draw inferences about strategy and strategy making that are either absent from other theories or in contradiction to them? What are the essential ingredients of a KBV?

Grant (1996) and Spender (1996) in a special issue of *SMJ* in 1996 have two much quoted papers that step outside conventional economic approaches. Grant (1996) sees the firm as an institution for integrating knowledge where knowledge is individually held and is typically tacit. The organisation's role is to access, transfer, and integrate that tacit knowledge within and throughout the organisation. His approach is very similar to that of Nonaka and Takeuchi (1995 (see Figure 6)). In Grant's view, the firm is a co-ordinating mechanism with implications for organisational design and for the nature of organisational process. Spender sees knowledge as too contentious a concept to easily bear the weight of a theory. The biggest problem, he sees, is the multitude of types and definitions. He therefore argues (as Grant does implicitly) for a pluralistic epistemology and advances the idea of interplay between explicit and tacit knowledge, and between different units within the organisation (from individuals through to collectives). This leads to different Weberian ideal types (see Figure 7). He moves from this to knowledge as activity and argues eventually for a Penrosian view – a historical,

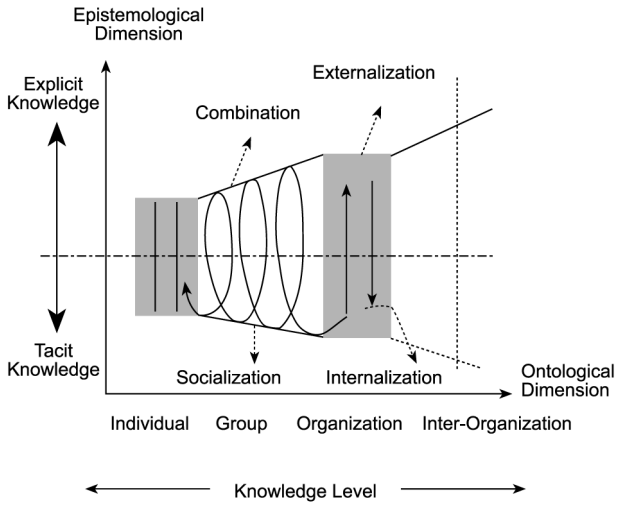

Figure 6.
Spiral of organisational knowledge creation

Source: Nonaka (1993)

	Individual	Social
Explicit	CONSCIOUS	OBJECTIFIED
Implicit	AUTOMATIC	COLLECTIVE

Source: Spender (1996)

Figure 7.
Different types of organisational knowledge

path dependent process in which the individual rather than machine bureaucracies are the important strategists.

It is useful to start with Spender's (1996, p. 48) view (Figure 7) that our concepts of knowledge are highly varied and in many ways inconsistent or incapable of being inter-related:

> Knowledge is a highly contentious concept, far too problematic to bear the weight of a useful theory of the firm without a clear statement of the epistemology which gives it meaning.

He then proceeds by making three points:

(1) Knowledge is the interplay between the tacit/implicit and the explicit, the horizontal dimension in Figure 7.

(2) This distinction allows for several different adaptation mechanisms – for example, Nelson and Winter's (1982) own use of adaptive feedback mechanisms where the interplay between tacit and explicit takes place through individual choices that are eventually embedded in organisational routines ("organisational genetics"), but note that "eventually" is highly under identified in this and most other models.

(3) Many theorists, starting with Polanyi (1966) and famously in Nonaka and Takeuchi (1995), see the origin of all knowledge in individual intuition. So the third element is the transformation and communication of what is known tacitly by individuals into collective or social knowledge. Hence the second dimension in Figure 7.

Therefore Spender advances four ideal types connected by an adaptation mechanism. He observes that the organisational intent is to transform tacit, individual knowledge into collectively owned, objectifiable knowledge – this is the world of standards, procedures, practices, patents, science, training, but still recognisably a world that remains dependent on the knowledge held by individuals although, in this diagram, the adaptation mechanisms of transformation and conversion process operate in silence. Given different types of knowledge are there different types of knowledge-based theory, Spender asks. A theory of conscious knowledge would have to solve agency

problems – how can inventors be persuaded to pass on their codified knowledge to an organisation? A theory based on automatic knowledge also has agency problems where the brilliant man must be persuaded to stay with the firm (see work-out clauses for entrepreneurs when they sell their businesses). A theory of objectified knowledge raises problems of imitability in a world where knowledge is explicit. A theory based on inherently immobile collective knowledge (this is where Nonaka and Takeuchi would wish to take us and where Nelson and Winter go with their extra rational learning processes) leads to a conclusion that this is the most secure and strategically significant kind of organisational knowledge.

Nonaka and Takeuchi's (1995) knowledge spiral (Figure 6) predates Spender by some three years. Their arena (matrix) has become a standard framework of its kind. Their focus is on a knowledge spiral, an adaptation mechanism through which knowledge is converted and then transferred between the tacit and the explicit (it can go either way) and among individuals, groups, and the whole organisation. Socialisation is the sharing of experiences so that tacit knowledge is shared between individuals, from individuals to the organisation through the development of culture and shared mental models, and from the organisation to individuals. Externalisation is the conversion of tacit into explicit knowledge through its articulation and systematisation within the organisation. Combination involves the conversion of explicit knowledge held by individuals and groups into explicit knowledge at the organisational level, and subsequent conversion of organisational knowledge back to the individual in different form. This is the key role of information systems within the firm. Internalisation is conversion of explicit knowledge back into tacit knowledge in the form of individual know-how and organisational routines. The knowledge spiral is the dynamic process by which knowledge is translated through separate but related stages, through socialisation to combination and externalisation, and back to internalisation. Thus individual creativity can be linked to the growth of collective knowledge[8]. Spender's contribution relates to the different types of organisational knowledge whereas Takeuchi and Nonaka use the same intellectual space to portray the adaptation mechanisms that organisations can use to convert and transfer various kinds knowledge to inimitable and therefore rent-earning organisational knowledge.

The value chain, popular for its simple and robust character, can be restated first, in the language of core competences and the RBV but more fundamentally in this language of knowledge. This characterisation creates a liner chain of activities that can be readily restated as a similar chain of core competences. The activities of the value chain might be dispersed across different owners but in any event they are controlled in economic terms through the operation of core competences. Thus economic power is operated through the conjunction and interaction of core competences. However, the linearity of the chain metaphor is uncomfortable where the empirical record suggests knowledge is multi-faceted and capable of being attached to other pieces of knowledge in a variety of expected and unexpected ways, particularly as interface standards are developed and "knowledge as Lego" becomes more and more possible.

The notion of a web is intuitively appealing (Figure 8). At the centre is the corporate glue, that organisationally held tacit knowledge that cannot readily be imitated – the "collective" knowledge according to Spender, and the knowledge architecture according to Henderson and Clark (1990). This is characteristically a collective concept but also a tacit and sticky concept meaning that the organisation can be

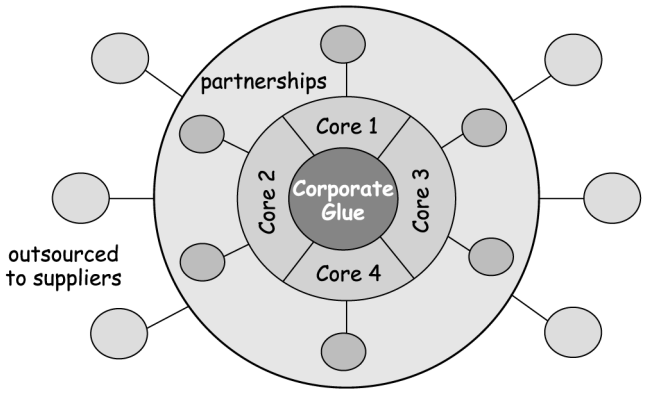

Figure 8.
The knowledge web

readily and sustainably differentiated by it. This corporate glue supports and is supported by a set of core competences within which elements of objectifiable knowledge may be evident[9]. These are buttressed by closely held partnerships where ability to control the agency costs becomes really important. More remotely managed are the sub-contract relationships where market contracting suffices. The value is a meta-level concept within which the activity sets formerly given pride of place in the value chain are replaced by knowledge concepts.

Inherent in a KBV and also in an economist's concept of a knowledge production function are the linkages between knowledge as assets, knowledge embedded in processes, and the pathways to competitive advantage. In the Teece *et al.* (1997) formulation, knowledge processes can be divided into entrepreneurial (creative), coordinative and integrative (static), learning (dynamic), and reconfigurational (transformational). In asset or resource terms we see knowledge as embedded in many different classes of assets such as technology, complementary, financial, reputational, structural, institutional, and market structure. For example, Amit and Schoemaker (1993) provide an excellent description of strategic assets and their linkage to organisational rent (competitive advantage). Following but not replicating Teece *et al.* (1997) we express the linkages to competitive advantage in terms of dynamic pathways. Whereas Amit and Schoemaker (1993) and Peteraf (1993) only assert the relationship between assets and rents, in this approach the linkages, dynamic pathways, are defined in terms of path dependency (which allows us to call on an evolutionary perspective) and technological opportunities (which allows for returns to scale[10], first/early mover advantage, and oligopolistic gaming). The strength of this approach lies in its organisational inclusivity, ranging from internal process to asset positions, linked over time through management of the pathways. Empirical support here is patchy but attracting research interest. This approach follows the approach of Teece in style but our additions to Teece are the inclusion of entrepreneurial (creative) processes and a more explicit characterisation of paths as dynamic links.

This literature enables us to see that there are elements of knowledge that can be related to sustainable competitive advantage. These knowledge concepts lie deep behind the well-known notions of strategic positioning and the RBV and are powerful in that they in a fundamental sense are the drivers behind core competences and competitive advantage. So, is it possible to draw this thinking together into a

perspective that we might call the KBV of strategy? Our approach is to suggest three categories (Figure 9) called specific knowledge, organisational knowledge, and the knowledge web[11]. Specific knowledge (Figure 10) relates to the knowledge production function and links as inter-related activities knowledge, production, access to knowledge, knowledge diffusion, connections between elements of knowledge, and knowledge renewal (including the discarding of knowledge). The foundations of this are highly dispersed. There is a considerable economic literature on innovation competition and R&D and in the scientific and social science literature on innovation processes. There is also some considerable mystery about creativity usually captured under the heading of serendipity.

Organisational knowledge (Figure 11) is the process by which various elements of specific knowledge are taken into the organisation, transformed into social/collective knowledge and through dynamic pathways linked into other organisational activities. The key elements (Figure 11) are characterised as types of organisation knowledge, the

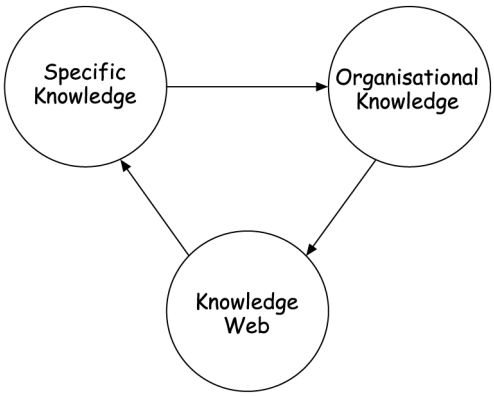

Figure 9.
Element of the knowledge-based view

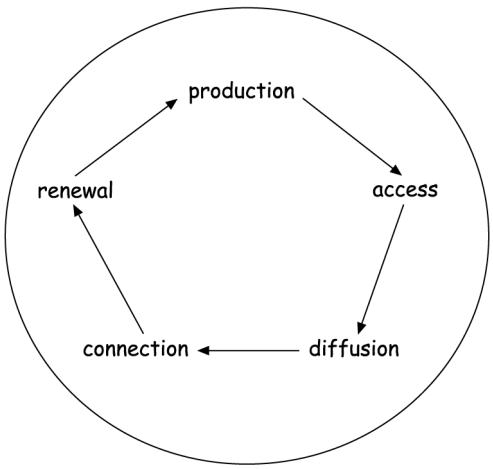

Figure 10.
Elements of specific knowledge

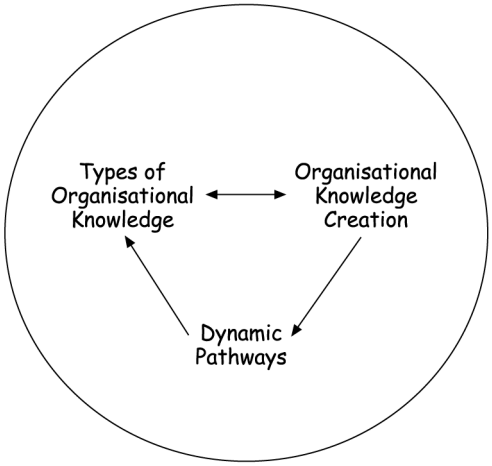

Figure 11.
Organisational knowledge

knowledge creation process, and dynamic pathways. The inheritance from Spender, Takeuchi and Nonaka, and Teece *et al.* are self-evident.

The knowledge web (already shown in Figure 8) represents the way in which specific knowledge and organisational knowledge is captured into value creating activities within the firm (discussed above) (see also Winter (1987) for an earlier exposition of this point). Both specific and organisational knowledge feed into the knowledge web. The notion of corporate glue or knowledge architecture stems directly from the conjunction of tacit and social knowledge. But specific knowledge is also evident from its role within core competences and within the core competences of strategic partners. The knowledge web is also dynamic in that incentives to innovate and to create new linkages between knowledge components are created here and therefore provide the link back to the knowledge production function that is captured within the category of specific knowledge.

This approach allows us to connect three strands. The first concerns the ways in which knowledge is produced, accessed, diffused, renewed, and discarded. The second concerns the notion of organisational knowledge an essentially invisible asset fostered and conditioned by visible and defined organisational routines and *ad hoc* processes. The third is a strategic theory of the firm in which positioning and resourced based approaches are recast in the form of knowledge[12]. Again, knowledge is the invisible asset but captured here in the form of specific activities on which management focuses attention. This does not answer all the questions but perhaps does allow us to define a set of interesting questions and permit the formation of some conjectures which link our analytic approach to the "enactment" approach offered in the literature of knowledge management. We suggest the following provides a useful linkage agenda:

- How is knowledge produced and accessed? This includes the imponderable of "knowledge creation" as well as the more prosaic "knowledge conversion" (a word used by Grant (1996) and by Nonaka (1994) and has a parallel to the economists' idea of a production function. We know more about the processes of innovation and we also know quite a lot about the economic analysis of new technology decisions.

- How does knowledge fit into supply chain and value chain thinking – in other words, how does it link and co-ordinate with the other activities of the firm to produce competitive advantage? The knowledge web is a useful *Gestalt* but much needs to be done to identify the specifics.
- How do pieces of knowledge connect up? How do they change the nature of the corporate "glue" – the integrative strategic architecture?
- What difference does any of this make for the analysis of strategic decisions such as diversification and acquisition? Does this have anything to contribute to economists' thinking about increasing returns industries - another arena where the "new economy" appears to be challenging basic assumptions behind traditional thinking (McGee and Sammut-Bonnici, 2002, 2003)?

These are not simply issues for shaping and assessing a theory, but they are also conjectures. They are conjectures about the nature of knowledge itself, whether such a multi-faceted concept can be marshalled into the constraints inherent in a normative, organisationally focussed theory.

9. Conclusions

Taking a reasonably broad view of the writings in and around knowledge and strategy we made a number of observations about extant thinking, relative to the enriched development of a strategic theory of the firm:

- Whereas knowledge was only implicit in the MBV of the firm it is a central element of the RBV.
- Dynamic theories of the firm cannot operate without some clear and operational concepts of knowledge. For example: tacit and explicit; and a knowledge production function incorporating innovating, accessing, transferring, integrating, and codifying.
- However, we sympathise with assertions that knowledge is a highly contentious concept. For example: know-how vs know-what; explicit vs implicit, individual vs. collective; knowledge as knowing, as learning, as activity, etc.
- Nevertheless, our conjectures about the applicability of knowledge as a significant explanatory variable may be supported empirically: for example see the wide range of citations in Eisenhardt and Santos (2001).
- The writing on organisational knowledge has shown it as the lynchpin between internal organisational structures and processes and the capture of economic rents.
- More controversially, there is a case for an evolutionary theory incorporating dynamic pathways as the external manifestation of organisational knowledge.

Our own approach to this has not been to attempt to provide "a unified theory of absolutely everything"[13]. Rather, we have attempted to find a way of incorporating knowledge variables into the explanation of the long run performance of firms and their long run sustainable competitive advantages from an analytic and economic perspective. To do this we offer a simple categorisation that links three types of literature, on specific knowledge – a very dispersed literature, on organisational

knowledge – which made considerable progress in the 1990s, and on the strategic theory of the firm. These strands we suggest are mutually reinforcing and interconnected. In particular, from a managerial perspective we can see how knowledge "issues" have a very direct economic content via the knowledge production/diffusion function, and a very organisational and individual element through the analysis of organisational knowledge. These do not stand, however, as separable issues although elements of the problem can be treated in isolation. Rather the system wide characteristics of knowledge are evident particularly in the knowledge web through which value creation activities are composed. In a subsequent paper, we shall attempt to marry analytic, economic and "enactment" views of knowledge into an enhanced framework for a strategic theory of the firm.

Notes

1. The use of the word narrow is to differentiate from economies of broad scope – the difference being the nature of the resource "hook", narrow being located typically within functions to explain product range scope, broad being wider and more generic in kind to support business diversity.
2. For a concise explanation see Besanko *et al.* (2000, pp. 117-9).
3. Nelson and Winter (1982) are most commonly identified with evolutionary economics. But the roots run deeper: see Veblen (1898) on cumulative change, Marshall (1920) on "economic biology" and his well-known appreciation of dynamic analysis, and Alchian (1950, 1963) on the implications of selection for the economic system.
4. See the teaching notes in De Wit and Meyer (1999) for a practical illustration. Also see Barney (1991) and Grant (1991) for similar deconstructions of resources.
5. The approach adopted in this section owes much to Menuhin (2001) and Menuhin and McGee (2003).
6. This is described and analysed in great detail by Vronen (1995).
7. See for example the antimarginalist critique exemplified by the Oxford Research Group in the 1930s, especially Hall and Hitch (1939) and the American economist Lester (1946).
8. The authors are indebted to Rob Grant for this articulation of Nonaka and Takeuchi's model.
9. An alternative description would be to describe the corporate glue as supported by elements of objectifiable knowledge and the conjunction of the two being core competence. This has the merit of defining core competence explicitly in terms of knowledge concepts.
10. Especially network externalities where "winner takes all" strategies are possible (McGee and Sammut-Bonnici, 2002, 2003).
11. Alternatively knowledge in action.
12. A link here could be made with Rumelt (1984) by developing the argument that our use of knowledge as corporate glue is directly analogous to his use of isolating mechanisms.
13. See the debates that have taken place in theoretical physics.

References

Abramowitz, M. (1986), "Catching up, forging ahead, and falling behind", *Journal of Economic History*, Vol. 46 No. 2, pp. 385-406.

Alchian, A.A. (1950), "Uncertainty, evolution and economic theory", *Journal of Political Economy*, June, pp. 211-21.

Alchian, A.A. (1963), "Reliability of progress curves in airframe production", *Econometrica*, No. 31, pp. 679-93.

Alchian, A.A. and Demsetz, H. (1972), "Production, information costs, and economic organisation", *American Economic Review*, Vol. 62 No. 5, pp. 777-95.

Amit, R. and Schoemaker, P.J. (1993), "Strategic assets and organisational rent", *Strategic Management Journal*, Vol. 14 No. 1, pp. 33-46.

Anderson, P. and Tushman, M.L. (1990), "Technological discontinuities and dominant designs", *Administrative Science Quarterly*, Vol. 35 No. 4, pp. 604-33.

Arrow, K. (1962), "Economic welfare and the allocation of resources for inventions", in Nelson, R.R. (Ed.), *The Rate and Direction of Economic Activity*, Princeton University Press, Princeton, NJ.

Barney, J. (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, Vol. 17 No. 1, pp. 99-120.

Besanko, D., Dranove, D. and Shanley, M. (2000), *Economics of Strategy*, 2nd ed., John Wiley & Sons, New York, NY.

Bettis, R. and Prahalad, C.K. (1995), "The dominant logic: retrospective and extension", *Strategic Management Journal*, Vol. 16 No. 1, pp. 5-15.

Brandenburger, A.M. and Nalebuff, B.J. (1995), *Co-opetition*, Doubleday, New York, NY.

Burgelman, R.A. (1983), "A model of the interaction of strategic behaviour, corporate context, and the concept of strategy", *The Academy of Management Review*, Vol. 8 No. 1, pp. 61-70.

Chandler, A.D. Jr (1990), *Scale and Scope: The Economics of Industrial Competition*, Harvard University Press, Cambridge, MA.

Christensen, C.M. (1997), *The Innovator's Dilemma*, HBS Press, Boston, MA.

Coase, R. (1937), "The nature of the firm", *Economica*, Vol. 4 No. 16, pp. 386-405.

Coase, R. (1988), "Lecture on the nature of the firm, III", *Journal of Law, Economics and Organisation*, Vol. 4 No. 1, pp. 33-47.

Cohen, M.D. and Baclayan, P. (1994), "Organisational routines are stored as procedural memory: evidence from a laboratory study", *Organisation Science*, Vol. 5 No. 4, pp. 554-68.

Cyert, R.M. and March, J.G. (1963), *A Behavioral Theory of the Firm*, Prentice-Hall, Englewood Cliffs, NJ.

D'Aveni, R.A. (1994), *Hypercompetition: Managing the Dynamics of Strategic Manoeuvring*, Free Press, New York, NY.

De Geus, A. (1988), "Planning as learning", *Harvard Business Review*, Vol. 66 No. 2, pp. 70-4.

De Wit, R. and Meyer, R. (1999), *Strategy Synthesis: Resolving Strategy Paradoxes to Create Competitive Advantage*, Thomson, London.

Eisenhardt, K.M. and Martin, J.A. (2000), "Dynamic capabilities: what are they?", *Strategic Management Journal*, Vol. 21 Nos 10-11, special, pp. 1105-21.

Eisenhardt, K.M. and Santos, F.M. (2001), "Knowledge-based view: a new theory of strategy?", in Pettigrew, A.M., Thomas, H. and Whittington, R. (Eds), *The Handbook of Strategy and Management*, Routledge, New York, NY.

Evans, P. and Wurster, T. (1997), "Strategy and the new economics of information", *Harvard Business Review*, Vol. 75 No. 5, pp. 70-82.

Evans, P. and Wurster, T. (1999), *Blown to Bits: How the New Economics of Information Transforms Strategy*, Harvard Business School Press, Boston, MA.

Ghemawat, P. (1991), *Commitment: The Dynamics of Strategy*, Free Press, New York, NY.

Gottinger, H.-W. (1998), "Technological races", *Annual Review of Economics (Japan)*, Vol. 38, pp. 1-9.

Gottinger, H.-W. (2001), "Stochastic innovation races", *Technological Forecasting and Social Change*, Vol. 68 No. 1, pp. 1-18.

Gottinger, H.-W. (2003), *Economics of Network Industries*, Routledge, London.

Granovetter, M. (1985), "Economic action and social structures", *American Journal of Sociology*, Vol. 91 No. 3, pp. 481-510.

Grant, R.M. (1991), "The resource based theory of competitive advantage: implications for strategy formulation", *California Management Review*, Spring, pp. 119-45.

Grant, R.M. (1996), "Toward a knowledge-based theory of the firm", *Strategic Management Journal*, Vol. 17, Winter, special issue, pp. 109-22.

Hall, R.L. and Hitch, C.J. (1939), "Price theory and business behaviour", *Oxford Economic Papers*, Vol. 2, Oxford University Press, Oxford.

Hamel, G. (2000), *Leading the Revolution*, HBS Press, Boston, MA.

Hamel, G. and Prahalad, C.K. (1993), "Strategy as stretch and leverage", *Harvard Business Review*, March-April.

Hedberg, B.L.T. (1981), "How organisations learn and unlearn", in Nystrom, P.C. and Starbuck, W.H. (Eds), *Handbook of Organisational Design*, Vol. 1, Oxford University Press, New York, NY, pp. 2-27.

Henderson, R.M. and Clark, K.B. (1990), "Architectural innovation: the reconfiguration of existing technologies and the failure of established firms", *Administrative Science Quarterly*, Vol. 35 No. 1, pp. 9-30.

Huff, A.S. (1994), "Mapping strategic thought", in Huff, A.S. (Ed.), *Mapping Strategic Thought*, 2nd ed., John Wiley & Sons, Chichester, pp. 11-52.

Jensen, M.C. and Meckling, W. (1976), "Theory of the firm: managerial behaviour, agency costs, and ownership structure", *Journal of Financial Economics*, Vol. 3 No. 4, pp. 305-60.

Johnson, G. and Bowman, C. (1999), "Strategy and everyday reality: the case for study of micro-strategy", working paper presented at the 15th EGOS Colloquium, Warwick, 2-14 June.

Johnson, G. and Huff, A.S. (1998), "Everyday innovation/everyday strategy", in Hamel, G., Prahalad, C.K. and Thomas, H.T. (Eds), *Strategic Flexibility: Managing in a Turbulent Economy*, John Wiley & Sons, Chichester.

Langlois, R.N. (1986), "Rationality, institutions, and explanation", in Langlois, R.N. (Ed.), *Economics as a Process: Essays in the New Institutional Economics*, Cambridge University Press, Cambridge, pp. 225-55.

Leonard-Barton, D. (1992), "Core capabilities and core rigidities: a paradox in managing new product development", *Strategic Management Journal*, Vol. 13, special issue, pp. 111-26.

Lerner, J. (1997), "An empirical exploration of a technology race", *The Rand Journal of Economics*, Vol. 28 No. 2, pp. 228-324.

Lester, R.A. (1946), "Shortcomings of marginal analysis for wage-employment problems", *American Economic Review*, Vol. 36 No. 1, pp. 63-82.

Levitt, B. and March, J.G. (1988), "Organisational learning", *Annual Review of Sociology*, Vol. 14, pp. 319-40.

McGee, J. (2003), "Strategy as knowledge", in Wilson, D. and Cummings, S. (Eds), *Images of Strategy*, Basil Blackwell, Oxford.

McGee, J. and Sammut-Bonnici, T. (2002), "Network industries in the new economy", *European Business Journal*, Vol. 14 No. 3, pp. 116-32.

McGee, J. and Sammut-Bonnici, T. (2003), "Emerging strategies for new industry structures", *European Business Journal*.

McGee, J., Thomas, H. and Wilson, D. (2005), *Strategy: Analysis and Practice*, McGraw-Hill, Maidenhead.

March, J.G. and Simon, H. (1958), *Organisations*, John Wiley & Sons, New York, NY.

Marshall, A. (1920), *Principles of Economics*, 8th ed., Macmillan Press, London.

Menuhin, J. (2001), "Strategising routines: the emergence of strategic initiatives", unpublished PhD thesis, University of Warwick, Coventry.

Menuhin, J. and McGee, J. (2003), "Strategising routines in HSBC (UK)", unpublished working paper, University of Warwick, Coventry.

Nelson, R.R. and Winter, S.G. (1982), *An Evolutionary Theory of Economic Change*, Belknap Press, Cambridge, MA.

Nonaka, I. (1993), "On a knowledge creating organization", paper presented at the AIF National Congress, Posma, October.

Nonaka, I. (1994), "A dynamic theory of knowledge creation", *Organization Science*, Vol. 5 No. 1, pp. 14-37.

Nonaka, I. and Takeuchi, H. (1995), *The Knowledge-creating Company: How Japanese Companies Create the Dynamics of Innovation*, Oxford University Press, New York, NY.

Penrose, E.T. (1959), *The Theory of the Growth of the Firm*, Basil Blackwell, London.

Peteraf, M.A. (1993), "The cornerstones of competitive advantage: a resource-based view", *Strategic Management Journal*, Vol. 14 No. 3, pp. 179-91.

Pike, S., Boldt-Christmas, L. and Roos, G. (2006), "Intellectual capital: origin and evolution", *International Journal of Learning and Intellectual Capital*, Vol. 3 No. 5, pp. 233-48.

Polanyi, M. (1966), *The Tacit Dimension*, Anchor Day Books, New York, NY.

Porac, J.F., Thomas, H. and Baden Fuller, C. (1989), "Competitive groups as cognitive communities: the case of the Scottish knitwear manufacturers", *Journal of Management Studies*, Vol. 26 No. 4, pp. 397-416.

Porter, M.E. (1980), *Competitive Strategy*, Free Press, New York, NY.

Porter, M.E. (1982), *Competitive Advantage*, Free Press, New York, NY.

Prahalad, C.K. and Hamel, G. (1990), "The core competence of the corporation", *Harvard Business Review*, May-June, pp. 79-81.

Quinn, J.B. (1978), "Strategic change: logical incrementalism", *Sloan Management Review*, Fall.

Rumelt, R.P. (1984), "Towards a strategic theory of the firm", in Boyden Lamb, R. (Ed.), *Competitive Strategic Management*, Prentice-Hall, Englewood Cliffs, NJ.

Scherer, F. (1991), "International R&D races: theory and evidence", in Mattsson, L.-G. and Stymme, B. (Eds), *Corporate and Industry Strategies for Europe*, Elsevier Science Publishers, New York, NY.

Schumpeter, J. (1934), *The Theory of Economic Development*, Harvard University Press, Cambridge, MA (originally published in 1911, republished 1968).

Senge, P. (1990), "The leader's new work: building learning organisations", *Sloan Management Review*, Fall, pp. 7-23.

Simon, H.A. (1955), "A behavioural model of rational choice", *Quarterly Journal of Economics*, Vol. 69 No. 1, pp. 99-118.

Simon, H.A. (1959), "Theories of decision-making in economics and behavioural science", *American Economic Review*, Vol. 49 No. 3, pp. 253-83.

Spender, J.-C. (1996), "Making knowledge the basis of a dynamic theory of the firm", *Strategic Management Journal*, Vol. 17, Winter, special issue, pp. 45-62.

Teece, D.J. (1980), "Economics of scope and the scope of the enterprise", *Journal of Economic Behaviour and Organisation*, Vol. 1 No. 3, pp. 223-47.

Teece, D.J., Pisano, G. and Shuen, A. (1997), "Dynamic capabilities and strategic management", *Strategic Management Journal*, Vol. 18 No. 7, pp. 509-33.

Veblen, T. (1898), "Why economics is not an evolutionary science?", *Quarterly Journal of Economics*, Vol. 12 No. 4, pp. 373-97.

Vronen, J.J. (1995), *Economic Evolution*, Routledge, London.

Weick, K.E. (1979), *The Social Psychology of Organising*, McGraw-Hill, New York, NY.

Weick, K.E. (1995), *Sensemaking in Organisation*, Sage, Thousand Oaks, CA.

Wernerfelt, B. (1984), "A resource-based view of the firm", *Strategic Management Journal*, Vol. 5 No. 2, pp. 171-80.

Williamson, O.E. (1981), "Strategizing, economizing, and economic organization", *Strategic Management Journal*, Vol. 12, Winter, special issue, pp. 75-94.

Williamson, O.E. (1985), *The Economic Institutions of Capitalism*, Free Press, New York, NY.

Williamson, O.E. (1987), "Transactions costs economics", *Journal of Economic Behaviour and Organisation*, Vol. 8 No. 1, pp. 617-25.

Winter, S.G. (1964), "Economic natural selection and the theory of the firm", *Yale Economic Essays*, Vol. 4 No. 1, pp. 225-72.

Winter, S.G. (1987), "Knowledge and competence as strategic assets", in Teece, D.J. (Ed.), *The Competitive Challenge – Strategies for Industrial Innovation and Renewal*, Ballinger, Cambridge, MA.

Further reading

Argyris, C. and Schon, D. (1978), *Organisational Learning*, Addison-Wesley, Reading, MA.

Brown, J.S. and Duguid, P. (1991), "Organisational learning and communities-of-practice: toward a unified view of working, learning and innovation", *Organization Science*, Vol. 2 No. 1, pp. 40-57.

Kogut, B. and Zander, U. (1992), "Knowledge of the firm, combinative capabilities, and the replication of technology", *Organisation Science*, Vol. 3 No. 3, pp. 383-97.

Tsoukas, H. (1996), "The firm as a distributed knowledge system: a constructionist approach", *Strategic Management Journal*, Vol. 17, Winter, special issue, pp. 11-25.

Corresponding author

Howard Thomas can be contacted at: Howard.Thomas@wbs.ac.uk