Resources, Technology and Strategy

Explorations in the resource-based perspective

Edited by

Nicolai J. Foss and Paul L. Robertson

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1 Introduction

Resources, technology and strategy

Nicolai J. Foss and Paul L. Robertson

Since the end of the 1980s there has been a notable change in the way that many academics in strategy research conceptualise the strategy process and how they think about strategic content. The strategy process is increasingly seen as beginning in a modest and 'introverted' way, by analysing the firm's portfolio of resources, rather than with such broad questions as, 'What is our corporate mission?' or 'What businesses are we in?' The content side of strategising is also increasingly cast in terms of resources. Thus, 'Our strategy is to get maximum market share in markets x, y and z' has given way to variants along the lines of 'Our strategies in markets x, y and z aim at more fully sharing resources a, b and c', or 'Our strategy is to stretch existing resources and create new ones so that we are not trapped by blurring industry boundaries.' There is clear, if unsystematic, evidence that this change is also taking place in managerial practice.

Much of this reorientation is due to the breakthrough in academic as well as practical strategy thinking of what is often referred to as '*the resource-based perspective*' (henceforth, 'the RBP'), which reaches back to the classic work of Edith Penrose (1959) and Philip Selznick (1957), but has only emerged as a strong contender on the strategic management scene in the mid-1980s with the work of Birger Wernerfelt (1984), Richard Rumelt (1984), Jay Barney (1986) and others.[1] The key ideas in the RBP are that successful firms possess heterogeneous collections of resources, that these varied collections of resources allow firms to implement different strategies, that different strategies yield different returns (which may be interpreted as rents accruing to the underlying resources), and that successful strategies and their associated return streams are sustainable to the extent that they are prohibitively costly to imitate. This is the perspective that all of the contributors to the present book begin from, before moving on to extend or criticise it in various ways.

In little more than a decade, the RBP has emerged as arguably the dominant contemporary approach to strategy (content) research – as perhaps the new orthodoxy in strategy research. The perspective's appeal to academics would seem to be a matter of combining relative analytical rigour with apparent managerial relevance. Thus, there are good reasons for the success of the RBP; however, there are certainly also reasons to hold one's breath and curb

enthusiasm, primarily because there are many unresolved problems and issues in need of clarification.

Most conspicuously, perhaps, there is a considerable amount of terminological ambiguity, with various resource-based theorists using concepts such as 'resources', 'competencies', 'capabilities', etc. to refer to what are seen as strategic assets. This problem may be overcome as certain terminological standards gradually become dominant in the community of resource-based theorists; it is essentially a minor problem.

However, there are also deeper issues in need of clarification and there are potentially conflicting insights. A conspectus of some existing problems with the RBP would include:

- *The isolated resource problem.* There is a tendency in the RBP to analyse some resources in isolation from others, so that systems effects and complementarities may be lost from the view of the analyst. Moreover, although no single resource may be central to a firm's strategy, the interplay between several resources may very well yield rents (Porter 1996; Robertson 1996).
- *The environment problem.* The RBP is overly 'introspective' (Porter 1994) and has a tendency to neglect the environment or only incorporate it implicitly under the rubric of such broad competitive forces as 'the threat of imitation'. Whereas the structure–conduct–performance (SCP) approach that dominated industrial economics for several decades assumed that the resources available to firms were homogeneous and that all important influences on performance could be traced to external factors such as market structure, the resource-based perspective tends to downplay the importance of external variables. In common with the SCP, however, the RBP takes demand as given rather than as a dynamic factor that firms can manipulate strategically.
- *The resource application problem.* Given that resources are central in the RBP, the actual application of resources in production has received scant analytical attention.
- *The resource organisation problem.* The RBP tells us very little about how resources are best organised (Williamson 1994). For example, if the resources in question are human resources, the services those resources yield are dependent on a host of determinants such as incentives, monitoring and culture that have been investigated in organisational economics and organisational behaviour studies. To date, the RBP has shown little interest in these matters.
- *The resource creation problem.* The RBP has concentrated overwhelmingly on the analysis of *existing* resources, and has given remarkably little attention to the creation of new resources. As a result, there is a distinctly retrospective character to the RBP, which may threaten its managerial relevance (Foss *et al.* 1995). Some authors, such as Kay (1993) who criticises 'wish-driven strategies', contend that firms cannot easily adapt

or augment their existing resources to embrace new strategic opportunities and are thus trapped by their histories. Pralahad and Hamel (1990), on the other hand, are more optimistic about the ability of firms to gather new resources in response to changes in their 'strategic intent', but are vague on how this can be accomplished.

There are other problems with the perspective, such as the lack of solid empirical work, but the problems above are major ones, and arguably *the* major ones. All the contributions to this book explicitly or implicitly grapple with these problems and suggest various remedies. For example, a number of contributors point out and discuss the fact that there is a lack of a clear and coherent treatment of dynamics in the RBP. Thus, the RBP does not in its present version(s) theorise in any convincing way about the mechanisms underlying the creation of new resources – what we have called 'the resource creation problem'. This problem is perhaps particularly troublesome for the future evolution of the RBP, since dynamics (broadly conceived) is all the rage in the strategy and organisational behaviour fields these days, as witness the recent enthusiasm about 'hyper-competition', 'organisational learning', 'the knowledge-creating company', etc.

It is true that some RBP theorists have tried to grapple with these issues, typically under the banner of 'the core competence approach', but this has only been done – it is fair to say – by substantially sacrificing rigour. On the other hand, many of the more economics-orientated contributions to the RBP exhibit a certain degree of rigour, but do not treat dynamics in any detail. The divide may be seen as largely a matter of whether one seeks to address and include dynamic – or better, *evolutionary* – factors, or instead relies on standard economic theory.

It is a choice, in short, between equilibrium and evolution, with 'evolution' and 'evolutionary' referring here to whether such concepts as irreversibility (e.g., in the form of path-dependence and learning) and novelty (e.g., in the form of unanticipated innovations) are included in the analysis at some level. In practice, dynamism and evolution are at the heart of strategic behaviour. Few managers are content with equilibrium; instead, they deliberately attempt to upset existing market positions. The goal of strategy research should therefore be to find an approach that treats evolutionary developments with something approaching the rigour that neoclassical economists bring to equilibrium situations. Although this is a tall order, it is the only way to generate a strategy literature that is both usable and analytically respectable.

As the title implies, our primary focus in this volume is on technological change. In particular, we are concerned with the ways in which a firm's resources are related to the product and process technologies that it adopts, and with the changes in other resources that may be needed to deal with changes in the firm's internal and external technological environments. In contrast to Solow (1956) and most other neoclassical economists, we treat technological change as being endogenous to firms, but unlike the 'New

Growth Theorists' (e.g., Romer 1986, 1990, 1993, 1994), we are searching for a fine-grained analysis of the motivation that underpins strategic behaviour at the firm level. The implied argument in most of the contributions is that, in order to account for the emergence and maintenance of the systematic heterogeneity among firms that is a basic premise of the RBP, and to derive managerial lessons with respect to issues such as resource building and corporate renewal, it is necessary to develop insights into the endogenous creation of resources. In the present state of analysis, heterogeneity is simply asserted, and dynamic and normative issues relating to endogenous heterogeneity are largely neglected. What the RBP needs, we suggest, is more agreement that these dynamic issues are crucial but should be approached in a more precise and analytical way than at present. If this does not happen, there is a real danger that the RBP may split even more deeply, first, into a formal, stark, abstract branch strongly inspired by economics and gradually losing contact with managerial reality, and, second, into an increasingly loose and free-wheeling branch where almost anything goes on the analytical level.

Technological resources and capabilities[2] can be viewed from several angles, many of which demonstrate the validity of the 'problems' that we have cited. The resources of any given firm can be broken down into a number of classes, both current and potential, with differing strategies calling upon different classes or combinations of classes for their success. As Edith Penrose (1959) emphasised, for example, administrative or managerial talent is one of the most important resources that a firm may have. She believed that the greatest factor behind the growth of firms is the presence of 'slack' administrative skills that results from managers learning to master recurrent problems. As learning occurs, managerial time is freed up to address new challenges. Among the other areas in which resources are important are production, marketing, research and development, raw material procurement, organisational culture and finance. Slack may arise from resources actually held at the moment (for example, excess manufacturing capacity) or from resources that can be tapped if needed (an ability to borrow funds to build and equip a new factory). In some cases, strategies may take advantage of resources that a firm has or can tap, but in other cases strategy may be formulated around a need to sidestep a relative weakness that a firm faces: a company that cannot afford the manufacturing and marketing investment required to become a full-line producer may decide instead to target a niche market.

The value of each type of resource depends on the nature of the technology strategy being pursued. Both 'the isolated resource problem' and the 'environment problem' are important in the application of the RBP to technological questions. Although Bill Gates's (1999) recent book gives the impression that Microsoft attempts to find 'digital' solutions to all problems, it is generally misleading to think that a firm whose operations are at all complex can follow a single technology strategy. Despite the emphasis in many publications on high-technology operations, mostly involving microchips, such strategies are not appropriate for the core operations of many businesses, which remain

resolutely low-to-middle tech. Historically, systemic technological change has always progressed slowly and unevenly, with backward and forward linkages taking many years to develop, giving rise to the 'reverse salients' described by Hughes (1992). Lateral linkages have, if anything, frequently been slower. Although improvements may have been 'in the air' (Marshall 1961) and the common currency of thought in particular industrial districts, the spread of technological analogies across space and industries has often taken decades.[3] In some cases, this has been a result of the economic logic of the situation. It would have made no more sense to build the entire European or American railway networks in a single push in the 1840s than equipping every house in Europe or the United States with a fibre optic connection would make today. Frequently, however, this slow diffusion of technologies also reflects inadequacies of knowledge and perception. Managers are generally not well acquainted with developments in other industries, and even when they have some knowledge they may not appreciate parallels between their own operations and those elsewhere.

As a consequence, technological unevenness is to be expected across industries, but unevenness is also the rule across resources and capabilities within the same industry and within the same firm. Instead of industries or firms following high-tech or low-tech strategies, they use a combination of technologies that change at uneven rates, and the overall effects of change cannot be accurately gauged if attention is focused on the technological trajectory of only one or two resources. In areas such as furniture manufacturing or food processing, for example, in which both product and process technologies remain comparatively unsophisticated, state of the art resources in sales and inventory management may be employed to great competitive advantage. Concentration of analysis on a single, isolated resource can obscure the significance in many situations of a mix of technologies, each of which is appropriate to a different important resource.

Furthermore, as industry structure and firm performance may interact as a result of technological change from outside the industry, an introspective approach to technology strategy can overlook vital interconnections between internal and external resources. Low- and medium-technology industries are embedded in networks of resources owned by others. For example, a change in the costs and speed of transport available to firms in a manufacturing industry can make it feasible for each firm to serve a larger market geographically, opening the way to enhanced economies of scale and other efficiencies without any change having occurred in the technology available within the manufacturing industry itself. Alternatively, the increase in scale could lead to the adoption of new technologies in the core industry, developments that would not have been efficient if the available markets were smaller. The upshot could well be a change in market structure, with an increase in overall sales but a reduction in the number of firms, as operators in isolated areas lose the protection provided by high transport costs.

The analytical problems associated with an introspective approach become even clearer if, not unreasonably, one assumes that many uses of technological

resources are 'socially constructed' (Bijker *et al.* 1987) in the sense that they reflect 'social and political negotiation among a variety of groups' (Ceruzzi 1998), including customers, regulatory bodies and other stakeholders in addition to technologists. Under these circumstances, the emerging strategic value of technological resources is far from linear, but reflects feedback loops as engineers and scientists are influenced by others in a complicated process. But, while it may be dangerous to ignore these complexities, they are also difficult to incorporate smoothly in a rigorous analytical framework. Dealing with complications of this order is one of the greatest challenges to the usefulness of the RBP.

'The resource organisation problem' is often associated with 'the isolated resource problem'. Neoclassical economists have long acknowledged that the choice of a technology depends on the relative costs of a range of factors, including labour and raw materials as well as capital equipment. In an evolutionary situation, path dependency can increase the complexity of technological choice. As Robertson and Alston (1992) have shown, for instance, the ability of a firm to adopt a new technology is in part a function of power relationships within the firm and how receptive its existing workforce is to change. Technological change can be competence destroying, competence enhancing or competence neutral (Tushman and Anderson 1986) from the standpoints of both the firm and its workers. Developments that are beneficial to the firm as a whole may nevertheless harm the interests of selected groups of workers. If these workers occupy strategic positions in the firm's production process, they can bargain to gain a larger share of the benefits flowing from technological change than employers had planned on when investing in new equipment, or even block change altogether. In both cases, further investment in technological change would be discouraged. To be realistic, the RBP has to be able to contend effectively with these sorts of developments that can affect the strategic use of resources.

Finally, to achieve its maximum degree of analytical usefulness, the RBP needs to cope both with the dynamic effects of technological change and with any accompanying need for new complementary resources. D'Aveni's (1994) picture of firms operating under conditions of 'permanent revolution' contrasts strongly with the stance taken by RBP theorists such as Barney (1991, 1997) and Peteraf (1993), who emphasise the role of 'sustained competitive advantage' in strategic policy formulation. The concept of 'hyper-competition' that D'Aveni presents highlights the role of change as an on-going strategic weapon, while the equilibrium-based wing of the RBP tends to view change as a one-off lunge for superiority and domination. Realistically, there is no more reason to expect that most firms will operate virtually forever in highly turbulent environments – that the oligopolistic accommodation that is generally said to characterise the mature phase of the product life cycle has been replaced by hyper-competition – than there is to believe that most firms have any hope at all of securing Ricardian rents into the indefinite future. Nevertheless, D'Aveni's view of hyper-competition does point up the dangers

involved in embracing the equilibrium approach of Barney and Peteraf. In a world of multiple sources of innovation, it is quite simply useless for most firms to search for strategies that will yield sustained competitive advantage. Emphasis on incremental change and differentiation is more feasible for the majority of companies. This, in turn, often entails concentration on building complementary resources to take better advantage of the opportunities offered by innovation in any single area, since, if firms are unable to package their core competences suitably, they risk substantial problems in appropriating the returns from their areas of strength. An analytical and retrospective fixation on equilibrium by RBP theorists can yield only limited returns. What is required is a framework that can explain both rapid and slow change across both wide and narrow fronts.

Many of the contributions to this volume refer to technology studies and innovation management. Most take a basic evolutionary approach, but try to retain rigour by discussing the endogenous creation of new resource in the context of established approaches, such as evolutionary economics (Metcalfe and James (chapter 3), Nicolai Foss (chapter 2), Hunt (chapter 4)), Austrian economics (Roberts (chapter 5)), and work on the theory of the firm (Kirsten Foss (chapter 9)).

In the process of grappling with dynamic issues, most contributions also deal with other important problems in the RBP. For example, in chapter 6 Sanchez provides an extensive discussion of modular products and processes and thus illuminates 'the resource application problem', that is, the problem in the RBP that the actual application of resources in production receives comparatively little attention. Similarly, in chapter 11, Yu and Robertson examine how resources are actually applied by small manufacturers in Hong Kong, given the strengths and weaknesses of these firms in comparison with their international competitors. Relatedly, a number of contributors – such as Kirsten Foss in chapter 9 and Langlois in chapter 10 – address 'the resource organisation problem'. For example, Kirsten Foss draws on recent work on property rights to address the organisation of learning in firms and combines property rights ideas with resource-based ideas to give a rationale for the existence of firms that does not hinge on considerations relating to the reduction of opportunism but rather emphasises that firms may be superior (relative to markets) mechanisms for conducting experiments (broadly conceived) in a cost effective manner.

'The isolated resource problem', that is, the tendency in the RBP to treat resources as if they were free-standing entities, is also dealt with in a number of contributions. For example, Christensen's discussion of what he calls 'dynamic coherence' (chapter 7) is a strong implicit denial of the meaningfulness of treating resources in an atomistic manner, since dynamic coherence is a property of a cluster of resources. Much the same point is made in Laamanen and Autio's discussion of the role of dynamic complementaries in technology acquisition (chapter 8). Yu and Robertson (chapter 11) examine how strengths in organisational resources provide compensation for weaknesses

in technological resources in Hong Kong, as well as assessing the limits of that compensation.

Also relating to this problem are the contributions that in various ways deal with the interaction between firms and their environments, such as Langlois' examination of vertical disintegration in the US semiconductor industry (chapter 10). In chapter 12, Shi looks at the transfer of technological resources from the perspectives of both the donors and the recipients. He describes one central strategy that the People's Republic of China has used to generate new technological resources to promote economic development and analyses the differing motives of high-tech and low-tech foreign firms for undertaking direct investment in the PRC.

The contributions to this book deal with core problems in the emerging resource-based perspective and aim to advance its problem-solving capacity and increase the range of issues to which it is relevant. Thus, the RBP is applied to topics relating to economic organisation, innovation and small-firm strategies. Taken as a whole, the contributions represent a significant advance with respect to the analytical tools the RBP may legitimately employ. In particular, they demonstrate the advantages of developing market process approaches to the RBP, such as Austrian and evolutionary economics.

Notes

1 The essential contributions to the RBP are collected in Foss (1997). A recent collection of papers is Montgomery (1995).

2 In a useful distinction, Amit and Schoemaker (1993) define *resources* as 'stocks of available factors that are owned or controlled by the firm', while *capabilities* 'refer to a firm's capacity to deploy *Resources*, usually in combination, using organizational processes, to effect a desired end'. In general we adhere to this distinction but, as capabilities are clearly also a resource, we will use the term *resources* when we refer to resources and capabilities in combination.

3 See the chart relating percentage of consumer use and years since the introduction of important innovations in Gates (1999: 118). The chart also indicates that the diffusion of some recent technologies such as the personal computer and the internet has occurred more quickly than the spread of the radio or the VCR. In some cases, however, the measurements depend crucially on the definition of the innovation. The slow spread of the VCR, which was initially introduced for commercial purposes in 1952, is attributable to the need to develop rather different technologies for home usage (Graham 1986). Once this was accomplished, diffusion was quite rapid.

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