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

The strategic implication of knowledge attributes

Understanding the conditions in which knowledge matters to performance

Rogerio Victer
Department of Management, Fairleigh Dickinson University, Madison, New Jersey, USA

Abstract

Purpose – The purpose of this paper is to refine the resource-based theory of the firm. It intends to deal with key theoretical issues affecting the development of a model that empirically captures the relevance of knowledge to performance. The research task is not only to look inside the firm in search of candidates for a strategic resource, but also to better understand how a resource becomes strategic as the consequence of specific attributes. This approach has the potential of providing a relevant insight into the characteristics that resources must possess as well as a more effective way to compare their relative relevance to competitive advantage.

Design/methodology/approach – Hypotheses are tested by a comprehensive panel data of 29 AIDS/HIV drugs from 1997 to 2010, covering the performance trajectory of more than 90 percent of all branded products in this segment.

Findings – Based on the VRIO framework (Barney 1991, 2001a), which asserts that resources need to be valuable, rare, inimitable, and difficult to organize in order to become a source of sustainable competitive advantage, the paper derives seven empirical constructs of technological knowledge. Five of these constructs are statistically significant, explaining up to 36 percent of the variance in sales outcomes. Results show that the most important resource attributes are value and organizational capabilities. Inimitability is partially relevant, but rarity is not.

Practical implications – Results suggest that the best way to generate competitive advantage is through continuous improvement of technological knowledge. This conclusion shows that knowledge heterogeneity is more strategically relevant to performance than knowledge immobility.

Originality/value – Differently from previous papers, instead of measuring how much a resource (or its accumulated stock) influences competitive advantage, this paper identifies and measures the attributes through which the resource matters to market outcomes. It is not the resource itself, but its strategic attributes which actually generate differential benefits to firms.

Keywords Performance, Innovation, Knowledge management, Strategic management, Panel data

Paper type Research paper

Introduction

The resource-based theory (RBT) of the firm considers knowledge an important resource (Conner and Prahalad, 1996). Some authors go even further by regarding knowledge as the most important strategic resource a firm can have (Grant, 1996; Nonaka and

This research paper would not have been possible without the support of many people. The author wishes to express his gratitude to Professor Anita McGahan, Professor Patricia Melloy, and Professor Francisco Polidoro for important inspirations and advice; to FDU's graduate assistants Zuzana Durisova and Josh Coron for their research support; to Life Science Analytics for access to the MedTrack database; and also to the organizers and participants of the 2012 Global Innovation and Knowledge Academy (GIKA) Annual Conference held at the University of Valencia and the Polytechnic of Valencia, Spain. All errors are mine.

Management Decision
Vol. 52 No. 3, 2014
pp. 505-525

0025-1747
DOI 10.1108/MD-04-2013-0235

Takeuchi, 1995; Spender, 1996). According to this perspective[1], a firm achieves a substantial advantage by creating or deploying knowledge more efficiently and effectively than its rivals. Yet, empirical studies have had difficulties supporting the relevance of knowledge to firm performance (Markman *et al.*, 2003). Just a small number of studies have statistically supported the direct relationship between knowledge and competitive advantage or performance (Newbert, 2007).

The inability to empirically support the core theoretical proposition linking a specific resource to performance differentiation generates doubts on the academic relevance of RBT (Hoopes *et al.*, 2003). Although RBT has become one of the most widely accepted conceptual perspectives in the strategic management field (Powell, 2001; Rouse and Daellenbach, 2002), this research agenda has faced a continuous struggle to parameterize its main concepts, to measure how resources create advantages to firms, and to become fully useful to managers (Priem and Butler, 2001). The objective of the current paper is to directly address this still prevalent shortcoming in the current RBT research agenda (Kraaijenbrink *et al.*, 2010). The study intends to deal with key theoretical issues affecting the development of a model that empirically captures the relevance of a resource to performance. Differently from previous papers in this tradition, instead of measuring how much a resource (or its accumulated stock) influences competitive advantage, we now identify and measure the strategic attributes through which the resource matters to market outcomes. We advocate that it is not the resource itself, but its strategic attributes which actually generate differential benefits to firms. The research task is not only to look inside the firm in search of candidates for strategic resources (Barney, 1995), but also to better understand how a resource becomes strategic as the consequence of specific traits. This approach has the potential of providing a relevant insight into the characteristics that resources must possess (Barney and Arikan, 2001; Newbert, 2008) as well as a more effective way to compare their relative relevance to competitive advantage.

Based on the VRIO framework (Barney, 1991, 1995, 2001a), which asserts that resources need to be valuable, rare, inimitable, and difficult to organize in order to become a source of sustainable competitive advantage, the paper derives seven empirical constructs of technological knowledge and then measures their corresponding impact on products' market performance. Using data from AIDS/HIV pharmaceutical drugs generated along a period of more than a decade (1997-2010), we found that five of these constructs are statistically significant, explaining up to 36 percent of the variance in sales outcomes. Results show that the most important resource attribute is value, followed by organizational capabilities. Inimitability is partially relevant, but rarity is not. This result has a major impact on managerial decision making: knowledge innovation seems more strategically relevant to performance than knowledge rivalry.

Before providing details on the final results and discussing implications to the management field, it is important to initially address some of the main limitations preventing the advancement of the RBT empirical agenda. Theoretical revision is required with the intent to revisit core concepts and also rearticulate the nature of their interrelationships. The paper is organized as follows: it begins by stressing the main theoretical foundation of RBT and how to resolve some of the shortcomings affecting the success of an empirical agenda. Then it formulates hypotheses based on knowledge-based constructs that empirically map the VRIO attributes. The following section is dedicated to the description of the data and the exposition of the model applied to test the hypotheses. The paper then turns to a discussion of the relevance and implication of the results for the RBT research project.

Theoretical foundations

Knowledge is not a homogeneous, undifferentiated resource. RBT had made much progress in the last few decades by focussing on the identification of the relevant characteristics of knowledge. Knowledge has been classified and defined in a variety of ways (Nonaka and von Krogh, 2009; Spender, 1996), the most promising ones being those contrasting the differences between tacit and explicit knowledge (i.e. whether knowledge is subjective or objective). The relevance of this dichotomy to management directly relates to the ability transfer knowledge from one agent to another, either at the level of individuals (Polanyi, 1966) or organizations (Nonaka and Takeuchi, 1995; Nelson and Winter, 1982). Teece (1977) focussed on identifying barriers for transferring knowledge from one party to another within the same organization. He showed that transfer costs were lower in the case of more mature technologies and when more firms were using the same knowledge. Winter (1987) proposed a comprehensive taxonomy based on four pairs of attributes of knowledge, in which the first element of each pair (i.e. codified, observable in use, simple, and system independent) denotes forms of knowledge that make it easier to transfer across agents, whereas the second element (i.e. tacit, hard to observe, complex, and system dependent) makes transferability more difficult. Kogut and Zander (1992), echoing the basic distinction between tacit and explicit knowledge, emphasized the distinction between know-how and information, in which know-how is the accumulated practical skill or expertise that allows one to do something smoothly and efficiently, while information is knowledge which can be transmitted without loss of integrity once the syntactical rules for deciphering it are known.

These seminal studies on knowledge have influenced and inspired many others in which issues of resource heterogeneity and immobility played a crucial role in theory development and empirical testing (e.g. Berman *et al.*, 2002; Birkinshaw *et al.*, 2002; Hatch and Dyer, 2004; King and Zeithaml, 2003). These issues have been basically treated from a technical or functional perspective, and mainly focussed on how to increase efficiency in the processes of knowledge creation, application, and transfer (Eisenhardt and Santos, 2002). Consequently, business-related arguments have been neglected or treated in a secondary manner. Given that RBT is essentially a theory of value creation dedicated to the field of strategic management (Kraaijenbrink *et al.*, 2010), it is important to link resources not only to processes and mechanisms, but also to performance.

The correlation between resource and performance is more sophisticated than common sense would predict. The magnitude of the relationship is generated in a dynamic comparative setting. Given that knowledge is heterogeneously distributed across firms and that this uneven distribution is likely to persist in time, knowledge gains strategic relevance to the firm as the consequence of its comparative traits (Barney, 1991). The fact that resources must be converted into customer value means that they also depend on unique innovative and commercialization capabilities (Barney, 2001a; Teece, 1986). Performance has been traditionally considered as the ability of the firm to produce more economically and generate more returns (Peteraf and Barney, 2003), but many RBT studies have applied alternative performance variables. In studies concerning knowledge, performance has been measured in many alternative ways, such as: retention of clients (Brush and Artz, 1999), the number of baskets or assists (Berman *et al.*, 2002), learning performance (Hatch and Dyer, 2004), patent citations (Markman *et al.*, 2003), and product performance (McEvily and Chakravarthy, 2002).

The strategic perspective on the relevance of resources to performance imposes a major empirical challenge: What are the conditions in which knowledge matters to

performance? In order to develop a relevant and comprehensive model to address this challenge, we suggest overcoming the following four (4) main RBT shortcomings (Priem and Butler, 2001).

Less inclusive definition of resources

RBT will benefit the most when it adopts a less inclusive definition of resources than the one currently in use. We advocate emphasizing that resources need to be necessarily embedded in the product (or service) offered by the firm. This means being faithful to the initial understanding that resources and products are two sides of the same coin (Wernerfelt, 1984), instead of relying on subsequent elaboration that resources are everything controlled by a firm that enables the implementation of strategies to improve efficiency or effectiveness (Barney, 1991a, p. 101). It is important to restrict the definition of resources to those elements directly related to the design of a product (or service) that generates outcomes to a firm. By restricting the definition of resources, the theory deals with a less generic proposition, and decreases the degree of tautology, which has characterized RBT models (Priem and Butler, 2001).

Contextualization

RBT is not traditionally concerned with the boundaries of an industry, since it was initially developed as a counter argument to the Industrial Organization school of thought that explains firm competitive advantage through environmental conditions. However, the appropriate contextualization is essential in order to generate theoretically relevant propositions. A resource is firm-level dependent, but its relevance and influence on performance is conditional to the degree of resource distribution across competing firms within a particular industrial sector (Henderson and Cockburn, 1994). Resources are not detached from actual historical situations and their relevance to performance highly reflects the characteristics of each particular market environment.

Operationalization of the relationship between resource and performance

The majority of empirical studies in the RBT tradition adopt a methodological approach whereby a specific resource is argued to be valuable, rare, inimitable, and difficult to organize, and then the amount of that resource is correlated with a firm's competitive advantage or performance (Newbert, 2007). This approach has only limited practical relevance to managers. In order to increase the relevance of RBT to managerial decision making, it is important to measure the relevance not of the resource *per se*, but of each one of its attributes that affects a firm's outcomes. This approach provides a better insight into the characteristics that resources must possess in order to improve a firm's competitive position. It is also a methodology promoting the comparison between strategic characteristics of resources. Managers can learn which one of the resource characteristics matter the most for success and then promote the right actions to generate and sustain superior performance.

Dynamic models

It is also important to avoid getting caught by a static perspective of the resource application. Resources are not supposed to influence performance in a permanent and continuous way, as in a standardized process. The impact of resources on the competitive advantage of a firm highly depends on the underlying dynamics of the marketplace and the prevailing competitive forces. The dynamics of competition generate evolutionary forces that shape the trajectory of innovation (Nelson and Winter, 1985), making resources

gain or lose strategic relevance according to a particular moment in the life cycle of the industry (Helfat and Peteraf, 2003). Resources as well as capabilities can potentially increase or decrease performance, depending on a permanent comparison of alternatives and their respective benefits to the end consumer.

Formulation of hypotheses

We suggest using technological knowledge as an exemplar of a strategic resource due to its direct linkage to the product (or service) provided by a firm and its difficulty of dissemination (de Carolis, 2003). Technological knowledge determines the design parameters and it is intrinsically dependent on complex skills (Cohen and Levithal, 1990; Patel and Pavitt, 1994). Firms that have access to idiosyncratic technological knowledge are capable of better attracting customers as the consequence of product functionality, cost, and reliability (Duffey and Dixon, 1990; Rosenberg, 1976). Consequently, technological knowledge is a strong candidate for influencing market and financial performance, allowing firms to exploit opportunities and respond to competitors (Dean and Kretschmer 2007; Wiklund and Shepherd, 2003).

Instead of measuring the direct implications of technological knowledge, this paper actually measures how much each specific strategic attribute of technological knowledge affects outcomes. This means that performance is conditioned by the VRIO attributes, and not by the resource itself. This subtle difference is illustrated in Figure 1 below, and captures the distinction between two different approaches within the RBT tradition: the resource heterogeneity approach and the conceptual-level approach (Newbert, 2007, p. 127). The model applied in the current paper promotes the former, less popular approach with the main intent to measure of the relevance of each separate attribute, based on the following hypotheses.

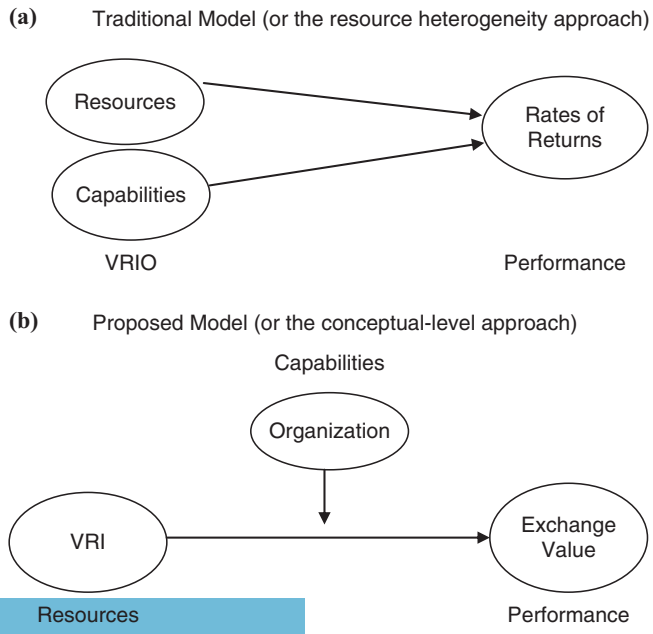

Figure 1.
Comparison between the traditional RBT model and the proposed model

1. Value

A. Knowledge distinctiveness. Technological knowledge generates value essentially by having a direct functional application in the resolution of a problem. Technological knowledge embedded in drugs is effective due to its technical competence in treating a particular disease. It carries with it a causal model of how the disease works or how its symptoms can be controlled. In the case of the AIDS, this means that the drug is effective in either killing the invading HIV virus or at least interrupting its damaging effects in the human body. AIDS drugs target enzymes directly responsible for the life of the HIV retrovirus (Este and Cihlar, 2010). A drug works effectively if it is based on a compound that neutralizes the action of the antigen according to a specific mechanism of action (MOA). MOA refers to the biochemical physiological process by which a drug produces a response in living organisms. The effect is the observable consequence of a drug action. Patented compounds can be classified according to their MOA, showing that MOA can be used as a criterion for representing different knowledge bases on pharmacology and human physiology (Reuben and Wittcoff, 1989). The main MOAs in the AIDS/HIV segment currently include: nucleoside reverse transcriptase inhibitor (NRTI), non-nuclear reverse transcriptase inhibitor (NNRTI), protease inhibitors (PI), integrase inhibitors (II), and fusion/entry inhibitors (EI):

H1. Drugs based on a compound using a particular MOA are dissimilar from each other, generating idiosyncratic effects on performance.

B. Knowledge maturation. Even after a particular drug design is created and commercialized, additional benefits to the end consumer are feasible as the result of further knowledge development. For instance, improvements can be fostered as the outcome of the increased experience of the scientists and technicians who are involved in R&D activities. The strategic element here is not necessarily better knowledge, but better functioning of the existing knowledge, which magnifies its original benefits. As a consequence, the maturation process allows the generation of an additional portion of benefits. In the AIDS/HIV pharmaceutical industry, this means the opportunity to formulate drugs with reduced toxicity, delayed resistance, improved absorption timing, and an increase in overall effectiveness due to increased patient adherence. Table I shows whether a drug belongs to the first or second generation of a particular MOA:

H2. Drugs based on a compound from a new generation of MOA has a positive effect on performance.

C. Knowledge integration. Physicians often prescribe therapeutic regimes that include a combination of drugs (or compounds). The adoption of a therapeutic regime with multiple drugs is a recognition that just one drug cannot do the job successfully and requires supplements. Combining compounds together in the same drug design is a way to enhance product effectiveness. In a way, the pharmaceutical firm anticipates the role of the physician by integrating in the same product all the necessary benefits required for an effective treatment. Combination treatments delimit an opportunity for greater effectiveness, as a fixed-dose combination increases patient's adherence. The combination of compounds increases the chance of survival making the infection into a chronic disease. In this sense, we can assume that the integration of different compounds based on the same or similar MOAs potentially increases performance

Brand name	Compound name	Firm	MOA	Market year	Generation	Multi-compound
Videx, ddI	Didanosine	BMS	NRTI	1991	1	0
Hivid	Zalcitabine, ddC	Roche	NRTI	1992	1	0
Zerit, D4t	Stavudine	BMS	NRTI	1994	1	0
Invirase	saquinavir mesylte, SQV	Roche	PI	1995	1	0
Epivir, 3TC	Lamivudine	GSK	NRTI	1995	1	0
Viramune	Nevirapine, NVP	Boehringer	NNRTI	1996	1	0
Norvir	Ritonavir, RTV	Abbot	PI	1996	1	0
Crixivan	Indinavir, IDV	Merck	PI	1996	1	0
Combivir	Zidovudine/lamivudine	GSK	NRTI	1997	1	1
Rescriptor	Delavirdine, DLV	Pfizer	NNRTI	1997	1	0
Viracept	Nelfinavir, NFV	Agouron	PI	1997	1	0
Ziagen	Abacavir, ABC	GSK	NRTI	1998	1	0
Sustiva, Stocrin	Efavirenz	BMS	NNRTI	1998	1	0
Trizivir	Zidovudine, lamivudine, abacavir	GSK	NRTI	2000	1	1
Kalestra, Aluvia	Lopivanir + Ritovanir, LPV/r	Abbot	PI	2000	2	1
Videx EC	ddI ec	BMS	NRTI	2000	1	0
Viread	Tenofovir, TDF	Gilead	NRTI	2001	1	0
Emtriva	Emtricitabine, FTC	Gilead	NRTI	2003	1	0
Fuzeon, T-20	Enfuvirtide	Roche	Entry/Fusion	2003	1	0
Reyataz	Atazanavir, ATV	BMS	PI	2003	2	0
Lexiva, Telzir	Fosamprenavir, FOS-APV	GSK	PI	2003	1	0
Epzicom	Abacavir/lamivudine	GSK	NRTI	2004	1	1
Truvada	Tenofovir/emtricitabine	Gilead	NRTI	2004	1	1
Aptivus	Tipranavir TPV	Boehringr	PI	2005	2	0
Atripla	Efavirenz, Emtricitabine, Tenofovir	Gilead	Combo	2006	2	1
Prestiza	Darunavir	J&J	PI	2006	2	0
Isentress	Raltegravir	Merck	II	2007	1	0
Selzentry	Maraviroc, MVC	Pfizer	Entry/Fusion	2007	1	0
Intelence	Etravirine	Tibotec	NNRTI	2008	2	0

Notes: Consolidated by the authors; based on media releases, financial statement, and industry analyst report compiled by Life Sciences Analytics

Table I.
List of AIDS/HIV drugs and main characteristics

through simple addition or through more complex synergistic interactions. Table I indicates the type of drug design per drug brand:

H3. Drugs based on multiple compounds using the same or different MOAs have a positive effect on performance.

2. Rarity

D. Knowledge commonness. The relevance of technological knowledge to performance reflects not only the distinctive utility of a certain knowledge base in comparison with other existing knowledge bases (i.e. inter-MOA competition), but also the distinctiveness of a product within the same knowledge base (intra-MOA competition). This simply

means that a product performance advantage is dependent on the quality of being exclusive, unique, or "one of a kind." If the same technological knowledge is shared by numerous existing rivals, then this technological knowledge, although intrinsically functional and efficient, is unlikely to generate performance differentials or any other type of business advantage. Relevant but common resources are, at best, simple sources of competitive parity (Barney, 1995). Table II shows the number of drugs per MOA per year:

H4. The number of drugs based on compounds using the same MOA has a negative effect on performance.

3. Inimitability

E. Knowledge diffusion. Imitation by rival firms is the most common threat to the relevance of technological knowledge. Imitation from rivals dissipates the economic relevance of knowledge applied in products (Rivkin, 2000). Knowledge circulates and gets diffused, reducing its uniqueness or originality even before the end of patents. The complexity, specificity, and tacitness of technical knowledge tend to play a more relevant role as barriers to imitation than patents *per se* (McEvily and Chakravarthy, 2002). They basically increase knowledge stickiness by increasing the costs of transferring knowledge across organizational boundaries (Williamson, 1985; Zahra and George, 2002). In any case, the temporal flow of information across firms generates a particular pattern of imitation, affecting the speed in which competition introduces new products with the same existing technological knowledge:

H5. The age of the MOA used by a drug has a negative effect on performance.

F. Replacement. In addition to imitation, another relevant aspect of the knowledge immobility attribute is the impact generated by substitutes. In addition to direct rivalry, knowledge also deals with the threat of replacement. This means that an existing drug applying a specific MOA faces competition not only from imitative drugs that build on the same knowledge-base, but also from substitute drugs that build on alternative MOAs to achieve similar therapeutic benefits (Danzon and Ketchan, 2007). In fact, the dominance of any particular technology carries with it a threat of replacement, because a problem to be solved requires a solution independent of the method of solving it (Schumpeter, 1934). Even when rivals cannot perfectly imitate a firm's innovation, they can often create alternatives with similar functionality (Nelson and Winter, 1985). Substitution can sometimes be even more detrimental to incumbents

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
NRTI	3	3	2	2	5	9	9	10	11	9	10	9	9	8
PI	2	2	3	3	5	5	7	7	7	8	9	8	7	6
NNRTI	0	0	0	0	1	2	3	3	3	4	4	3	3	3
EI	0	0	0	0	0	0	1	1	1	1	2	2	2	1
II	0	0	0	0	0	0	0	0	0	0	1	1	1	1
MOA-Combo	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Total	5	5	5	5	11	16	20	21	22	23	27	24	23	20

Table II.
Number of drugs per MOA per year

Notes: Consolidated by the authors; based on media releases, financial statement, and industry analyst report compiled by Life Sciences Analytics

than imitation or direct rivalry, because it threatens not only the product, but also a firm's existing resource profile (Polidoro and Toh, 2010). Table III shows the number of drugs per MOA per year. Table II shows the number of drugs commercialized per year based on MOA affiliation:

H6. The number of drugs based on compounds using alternative MOAs has a negative effect on performance.

4. Organizational capability

G. Firm-specific knowledge. Technical knowledge influences performance not only because compounds use different MOAs, but also because firms have distinct capabilities of developing and commercializing those compounds. The full potential of technical knowledge depends on managerial actions and systems that ultimately increases value to the end user. The process of developing and deploying knowledge depends on unique corporate capabilities, which means that technological knowledge loses its relevance to product effectiveness outside a particular organizational context. Table I indicates the corporate control of each drug brand:

H7. Firms commercializing AIDS drugs using the same or distinct MOAs are dissimilar from each other in their ability to create and deploy knowledge, generating idiosyncratic effects on performance.

Data and method

In order to measure the relationship between the selected attributes of technological knowledge and performance, we rely on empirical data generated by branded drugs commercialized in the AIDS/HIV segment. The study of the pharmaceutical industry has many advantages: few other industries possess such a direct relationship between knowledge resources and the end product. Drugs are essentially the result of the discovery of novel chemical or biological compounds, and they directly reflect the application of scientific advancements.

The current data reflect global sales of AIDS/HIV drugs from 1997 to 2010. Data were collected primarily from industry analyst reports and public financial statements of the ten largest firms operating in this industry sector. A total of 29 drugs were considered, covering the performance trajectory of 90 percent of all brands commercialized in the global market. Sales volume of branded drugs has increased consistently since 1997 at a pace of 18 percent a year. Currently, the whole market for

Variables	Log sales	Maturation	Integration	Uniqueness	Diffusion	Replacement
Log sales	1.0000					
Maturation	0.3445*	1.0000				
Integration	0.4471*	0.2668*	1.0000			
Commonness	0.0077	0.0151	0.2089*	1.0000		
Diffusion	0.0258	−0.0125	0.2545*	0.7759*	1.0000	
Replacement	−0.0483	0.1715	0.0200	−0.1380	−0.1617	1.0000

Notes: The constructs knowledge distinctiveness and firm-specific knowledge are not included in this exhibit because they are categorical variables. Significance levels: *$p < 0.05$; **$p < 0.005$; ***$p < 0.001$; ****$p < 0.10$

Table III.
Correlation between variables applied in the full model

branded drugs is approximately $16 billion/year. Figure 2 depicts how the market for branded drugs is highly competitive and dynamic, composed of many rival brands and alternating leaders.

Hypotheses articulated in the previous section are tested by a time series methodology in which an ordinary least-square (OLS) method is applied to estimate the parameters for the selected independent variables. The data are organized as a panel data set of global sales of AIDS/HIV drugs from 1997 to 2010. The use of panel data has a great advantage over conventional cross-sectional data sets. Panel data combine cross-sectional and time-series data sets simultaneously, creating favorable conditions for testing complex behavioral hypotheses, such as those involving evolutionary change. Panel data allow the researcher to analyze a number of important questions that cannot be addressed using data from just one year. Panel data comprise repeated over-time observations on the same sample of units. They are used in social sciences to test theories of individual and social change. Change is explicitly incorporated into the design of the methodology so that variations in specific variables are properly measured. Panel data increase the degree of freedom and mitigates collinearity among the effects given that the sample provides a large number of data points over time, utilizing information both on the inter-temporal dynamics as well as on the individuality of the entities being investigated (Hsiao, 2003). The distinctiveness of the panel data applied here is that it contains measures of the same constructs from numerous drugs observed repeatedly through time. Consequently, there is a favorable condition for the analysis of causal interrelationships among variables (Finkel, 1995).

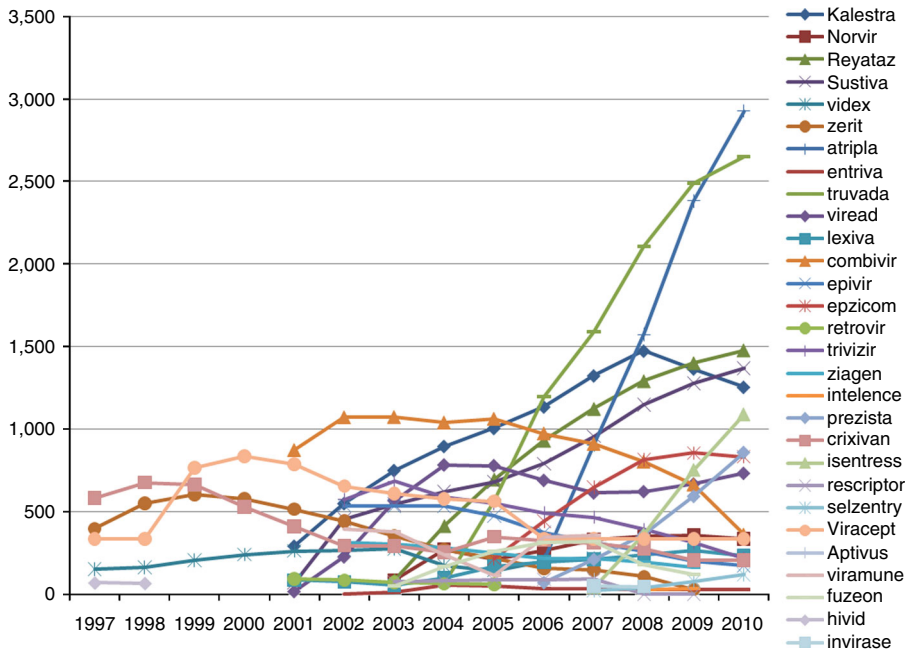

Figure 2.
Sales per branded drugs

Notes: Consolidated by the authors; based on media releases, financial statement, and industry analyst report collected by Life Sciences Analytics

We suggest the following core equation:

$$\ln(y_{kjit}) = \mu_o + \sum_{(i=2,n=5)} \delta D + \tau M + \sigma I + \lambda C + \eta D + \kappa R + \sum_{(j=2,n=10)} \beta F + \varepsilon_{jikt} \quad (1)$$

where the dependent variable ln (y_{kjit}) is the logarithm of global sales (in millions of dollars) of drug k using MOA i, commercialized by firm j, in year t; δ represent a vector of parameters of dummies for each distinctive MOA D; τ is the parameter of knowledge maturation M; σ is the parameter of knowledge integration I; λ is the parameter of knowledge commonness C; η is the parameter of knowledge diffusion D; κ is the parameter of knowledge replacement R; and β represents a vector of parameters of dummies for each pharmaceutical firm F. The residual is represented by ε_{jikt}. For the sake of facilitating understanding, all hypotheses, constructs, and measurements are visually displayed in Figure 3.

Although panel data sets have many advantages over cross-sectional data sets, they have nevertheless relevant shortcomings as a reflection of the non-stationary nature of the observation. Hence, panel data tend to generate a series of biases. This is particularly relevant in cases in which data collection is not controlled experimentally. In these situations, as in the present case, it is not feasible to account for the fact that each drug may be subjected to influences of unique factors not formally controlled in

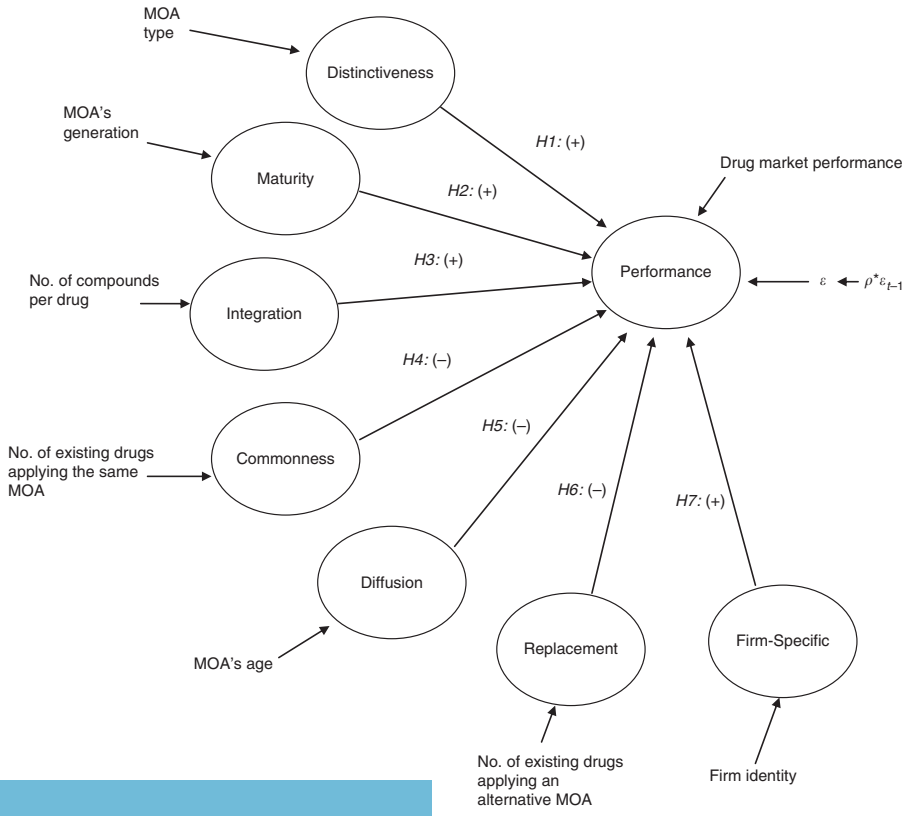

Figure 3.
Visual display of all hypotheses (including empirical measurement)

Equation (1). Ignoring such heterogeneity can lead to inconsistent and meaningless estimations. One of the main sources of distortion is directly related to serially correlated disturbances, such as the autocorrelation of the residuals. Residual in one particular year is not necessarily independent from residuals in previous years. Here we attempted to correct the effects of this kind of bias by the adoption of a first-order autoregressive methodology (AR-1), which lies in the assumption that disturbances on residuals are considered to depend only on its own previous value (the Markov property) and a random, "white noise" component. The coefficient of the autocorrelation of the residual (ρ) is then used to adjust all other variables, including the dependent variable (following procedure suggested in McGahan and Victer, 2010 and facilitated by *Stata 11*'s commands, such as the Prais-Winston and Cochran-Orcutt options).

Results

We tested each hypothesis separately and then collectively as part of a full model. Table III displays the correlation between the (continuous) variables, while Table IV displays all relevant results for each hypothesis testing separately.

Given that the dependent variable is log-transformed, but the independent variables are not, interpretation of the results requires a relatively simple transformation. We can easily interpret the regression coefficient in an OLS model as the expected change in log of sales with respect to a one-unit increase in the independent variable, holding all other variables at a fixed value. In order to better interpret the effect on actual sales, the natural way to do this is to exponentiate the regression coefficient, since exponentiation is the inverse of a logarithm function.

Hypothesis 1

The first hypothesis is accepted, since the model considering the effect of each MOA in product performance is statistically significant with a coefficient of determination (R^2) of 4.51 percent (at $p < 0.05$). This test confirms that technological knowledge related to a MOA applied by drug brands differs from each other. However, comparing the coefficients, we can conclude that only II seems to significantly differ from the other four MOAs. In this partial model, the intercept estimates the geometric mean of market performance for NRTI, which is the exponent of 6.4518 or $633.84 million. The MOAs representing non-NNRTI, PI, and entry inhibitor (EI) do not have significant coefficients, so they do not differ from NRTI, and are expected to generate the same geometric mean. Drugs applying II, however, have a significant coefficient of 0.7098, which allows us to infer that switching the composition of a drug from another existing MOA to II will generate around 103 percent increase in the geometric mean of sales. If the same test were to be conducted without correcting for the time series, the increase would be around 5 percent only.

Hypothesis 2

The second hypothesis is also accepted. The partial model considering the construct knowledge maturity estimates that the market outcome of a new generation of a MOA is significantly higher that the first generation. In fact, the effect of maturity on market performance is so impressive that the model estimates an increase of more than 1,700 percent given the speed in which this kind of drugs gain market share in relatively short period of time. The examples are Truvada, Atripla, and Reyataz, which went from zero to more than $2 billion in international sales within three years. This is an indication that once a new generation of MOA is launched, drugs adopting it almost immediately capture

Attributes	Variables	*H1*	*H2*	*H3*	*H4*	*H5*	*H6*	*H7*	Full model
Value	*NRTI*	6.4518*** (0.5178)							NA
	NNRTI	0.1358 n/s (0.8115)							0.3300n/s (0.8007)
	PI	−1.3085n/s (1.2144)							−1.2783n/s (0.8113)
	EI	0.7271n/s (1.7097)							0.6112n/s (2.0987)
	II	7.1616** (2.6279)							3.8997* (1.7021)
	Maturation		2.9431*** (0.5160)						1.3524**** (0.7275)
	Integration			1.8458** (0.6149)					1.9487** (0.56667)
Rare	*Commonness*				0.0331n/s (0.0356)				0.0385n/s (0.0385)
Inimitability	*Diffusion*					−0.1941** (0.0654)			−0.17344*** (0.0471)
	Replacement						0.0257n/s (0.0210)		0.0194n/s (0.0201)

(*continued*)

Table IV.
Core result per hypothesis (considering a log-transformed dependent variable)

Attributes	Variables	*H1*	*H2*	*H3*	*H4*	*H5*	*H6*	*H7*	Full model
Organization	*Abbott*							7.7815*** (1.2067)	NA
	Agouron							−4.5533* (1.9078)	−1.3951n/s (0.9923)
	Boehringer							−2.3747n/s (2.5879)	−0.1121n/s (1.6931
	Bristol							−0.9292n/s (1.4529)	1.8497* (0.9349)
	Gilead							1.6756n/s (1.5169)	1.9572* (1.1171)
	J&J							1.8342n/s (2.4132)	1.7933n/s (1.3023)
	Merck							−0.7123n/s (1.7063)	−0.1187n/s (0.9497)
	Pfizer							0.2637n/s (2.8297)	−0.0205n/s (2.4613)
	Roche							−1.8715n/s (2.1752)	−0.9494n/s (1.8847)
	Glaxo							−3.0295* (1.3731)	0.4017n/s (0.8472)

(*continued*)

Table IV.

Attributes	Variables	*H1*	*H2*	*H3*	*H4*	*H5*	*H6*	*H7*	Full model
	Intercept	NA	5.4945*** (0.2587)	5.8641*** (0.2959)	6.3396*** (0.4902)	11.0686*** (1.621)	6.0941*** (0.5306)	NA	5.7731** (1.6538)
	Obs	203	203	203	203	203	203	203	203
	R^2	4.51%*	13.93%***	4.29%**	0.4300%n/s	4.19%**	0.74%n/s	12.20%**	35.91%***
	Test result	Accept	Accept	Accept	Reject	Accept	Reject	Accept	

Notes: NA (not applicable) means that the intercept estimates the coefficient of the first element in the list: the first MOA is NRTI (first to be launched) and the first firm is Abbott (alphabetic order). In the full model, the intercept estimates the coefficient of Abbot's NRTI drugs. Significance levels: *$p < 0.05$; **$p < 0.005$; ***$p < 0.001$; ****$p < 0.10$

Table IV.

market share from drugs adopting the previous version of MOA. This partial model explains 13.93 percent of performance variance and it is the knowledge construct that independently explains the largest portion of product performance.

Hypothesis 3

The third hypothesis is also accepted. The partial model considering the construct knowledge integration estimates that the market outcomes of drugs applying different compounds using the same or different MOAs is significantly higher than drugs based on single compounds. Most of the drugs in this category actually combine compounds within the same MOA. Only Atripla integrates two different MOAs in the same formula as the result of an agreement between Gillead and BMS. Similarly to knowledge maturation, knowledge integration considerably increases market share and overall performance. Sales of combo drugs tend to increase in the order of 533 percent from the base line of drugs with just one compound. This partial model explains 4.29 percent of the variance in market performance.

Hypothesis 4

The fourth hypothesis is rejected, since the number of existing products applying the same MOA in year t is not statistically significant. The intercept of this partial model is significant, indicating that the unconditional geometric average of an HIV drug is the exponent of 6.34 or \$567 million, showing that any AIDS drug is likely to generate half a billion dollars in sales. A large expected revenue indicates a certain degree of rarity in face of increasing demand. However, this average does not necessarily change with an additional rival resource (i.e. knowledge base), indicating that direct MOA rivalry is not a relevant condition to change expected market performance of a drug, at least not at this stage of the AIDS industry's life cycle.

Hypothesis 5

The fifth hypothesis is accepted. The construct knowledge diffusion, measured through the age of a MOA, has a coefficient of -0.1941, statistically significant at the level of $p < 0.005$. This means that a drug is expected to decrease performance around 17 percent every year as part of a larger process of the depreciation of its technological knowledge base due to imitation (possibly new entries from generics). If the quantity of direct rivalry is not significant, the overall effect of rivalry is better captured through the flow of time. Even if data on the exact number of generics were available, it most likely would not generate a significant result in this context. Measuring imitation through the effect of time (i.e. aging) makes more sense, since we are interested with the net effect of imitation. This partial model explains 4.19 percent of the market performance variance.

Hypothesis 6

The sixth hypothesis is not accepted, since the number of existing substitutes, or the number of products applying a different MOA than product i in year t, is not statistically significant. This means that the expected performance level of a HIV drug is unlikely to change, because a new substitute product enters the AIDS pharmaceutical industry. This is certainly the most surprising result based on the relevance given to resource substitution in RBT literature.

Hypothesis 7

The last hypothesis is accepted, generating a significant R^2 of 12.20 percent, indicating that firm-specific knowledge is not only statistically significant, but it is the second

most relevant attribute of knowledge. This empirical result points to the fact that firm-based differences in management are relevant to product market performance. However, according to the data, eight firms have statistically similar overall performance, with the exception of Agouron and GSK. Results would be very different if the model did not consider a time series model, showing the relevance of working with corrected panel data.

After running each hypothesis separately, a full model with all seven constructs on technological knowledge was run with the purpose of confirming overall results. In fact, all hypothesis tests were confirmed having the same results: *H1*, *H2*, *H3*, *H5*, and *H7* were accepted, whereas *H4* and *H6* were rejected. However, there are some changes in construct coefficients. In terms of differences in firm-specific knowledge, the full model shows that the firms that are different from the others are Gillead and BMS, both with a positive coefficient, indicating that they are expected to generate higher levels of market performance than the other eight firms, when all the knowledge constructs are controlled simultaneously. In terms of knowledge maturation and knowledge integration, both continue to have a positive impact on performance, but in the full model, knowledge integration becomes more relevant than knowledge maturation. The decrease in relevance of knowledge maturation might be related to collinearity with MOA fixed-effects, since the benefits of a new generation varies from one MOA to the other. The full model explains 36 percent of the overall performance variance within the period covered. This is just a 3 percent loss in explicative power in comparison with an addition of the R^2 of the partial models (39 percent). This change was generated by the reduction of the explicative power of the new generation of drugs within the same MOA.

Discussion

The current paper aims at contributing to the development of the RBT of the firm. It has provided both theoretical and empirical support for the core assumption that knowledge is a performing-influencing resource. Previous conceptual papers strongly stressed the relevance of knowledge as a privileged source of competitive advantage. Yet, we still do not know the actual strength or the form of the relationship between knowledge and performance. We suggest understanding the nature of this relationship through the emphasis on resource's strategic attributes. This approach has the potential of refining the original RBT assumption: it shows that it is not the resource, but certain characteristics of the resource that ultimately matters to performance.

Instead of identifying a resource that has simultaneously all the VRIO attributes and then measuring how the resource stock affects outcomes, the model adopted here inverts the traditional approach. It identifies an essential resource that is embedded in a product and then measures the relative relevance of its VRIO attributes. Consequently, the paper points that the best way to understand the relevance of a resource is to focus on those conditions in which a resource really matters to outcomes. This approach not only contributes to the process of empirically corroborating the main RBT proposition, but also clarifies the critical path in which a resource generates differentiated performance.

The paper also contributes to managerial practices. Understanding the conditions in which knowledge matters to performance has a direct implication to management activities. Based on the case of the AIDS pharmaceutical industry, we have learned which resource attributes are relevant, whether they increase or decrease performance, and also how they compare to each other. Results indicate that the characteristics of knowledge captured by the attributes of value and organization (the VO part of the

VRIO framework) are more relevant to performance than the attributes of rarity and inimitability (the RI part of the VRIO framework). This empirical evidence suggests that competitive advantage is essentially generated through the improvement of technological knowledge. This result seems to diminish the relevance of strategies anchored on raising barriers to imitation. Although diffusion of knowledge certainly depreciates competitive advantage as the result of new entries, it is the improvement of existing knowledge that is the most relevant factor generating growth in market outcomes. This evidence has potentially a major impact on management's role, showing that a firm can benefit more from promoting innovation than preventing rivalry.

As in any other study, the present one deals with some weaknesses. The first one is that conclusions are not easily generalizable to other industries or even to other pharmaceutical segments. Given the relevance of the market context, empirical results might vary considerably across industrial boundaries. The second weakness is that the current model does not allow a precise understanding of organizational capability. Here this strategic attribute is measured through a broad categorization generated by a firm's identity. It does not allow a clear differentiation of the actual processes underlying the ability of the firm to efficiently and effectively create and deploy knowledge. It is very important to be able to distinguish first-order attributes (such as product development) from second-order attributes (such as dynamic capabilities). The first kind of attribute is related to a firm's unique capability to commercialize an existing knowledge, while the second kind is related to a firm's unique capability to learn how to create new knowledge (Teece, 2000; Huber, 1991). These capabilities are very different from each other, although it is very difficult to empirically disentangle them. Potentially, dynamic capabilities are more important than product development or other marketing processes, simply because dynamic capabilities are a special kind of firm-specific tacit knowledge that has the generative power of creating other kinds of resource (Peteraf, 1993). Future extension of this study will have to consider alternative methodologies in order to address these major shortcomings.

Note

1. RBT is a broad theoretical school of thought encompassing three conceptual branches: the resource-based (RBV), the dynamic capability (DCV), and the knowledge-based (KBV) views of the firm (Priem and Butler, 2001; Barney, 2001a, b; Grant, 1996; Mahoney and Pandian, 1992).

References

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

Barney, J. (1995), "Looking inside for competitive advantage", *Academy of Management Executive*, Vol. 9 No. 4, pp. 49-61.

Barney, J. (2001a), "Is the resource-based view a useful perspective for strategic management? Yes", *Academy of Management Review*, Vol. 26 No. 1, pp. 41-56.

Barney, J. (2001b), "Resource-based theories of competitive advantage: a ten-year retrospective on the resource-based view", *Journal of Management*, Vol. 27 No. 6, pp. 643-650.

Barney, J. and Arikan, A.M. (2001), "The resource-based view: origins and implications", in Hitt, M.A., Freeman, R.E. and Harrison, J.R. (Eds), *Handbook of Strategic Management*, Blackwell Publisher, Oxford, pp. 124-188.

Berman, S., Down, J. and Hill, C. (2002), "Tacit knowledge as a source of competitive advantage in the national basketball association", *Academy of Management Journal*, Vol. 45 No. 1, pp. 13-31.

Birkinshaw, J., Nobel, R. and Ridderstrale, J. (2002), "Knowledge as a contingency variable: do the characteristics of knowledge predict organization structure?", *Organization Science*, Vol. 13 No. 3, pp. 274-289.

Brush, T.H. and Artz, K.W. (1999), "Toward a contingent resource-based theory: the impact of information asymmetry on the value of capabilities in veterinary medicine", *Strategic Management Journal*, Vol. 20 No. 3, pp. 223-250.

Cohen, M. and Levithal, A. (1990), "Absorptive capacity: a new perspective on learning and innovation", *Administrative Science Quarterly*, Vol. 35 No. 1, pp. 128-152.

Conner, W. and Prahalad, C.K. (1996), "A resource-based theory of the firm: knowledge versus opportunism", *Organization Science*, Vol. 7 No. 5, pp. 477-501.

Danzon, P. and Ketchan, J. (2007), "Reference pricing of pharmaceuticals for medicare: evidence from Germany, the Netherlands, and New Zealand", NBER Working Paper Series No. 10007, Cambridge, MA.

Dean, A. and Kretschmer, M. (2007), "Can ideas be capital? Factors of production in the postindustrial economy: a review and critique", *Academy of Management Review*, Vol. 32 No. 2, pp. 573-594.

De Carolis, D. (2003), "Competences and imitability in the pharmaceutical industry: an analysis of their relationship with firm performance", *Journal of Management*, Vol. 29 No. 1, pp. 27-50.

Duffey, M. and Dixon, J. (1990), "A program of research in mechanical design: computer-based models and representations", *Mechanism and Machine Theory*, Vol. 25 No. 3, pp. 383-395.

Eisenhardt, K.M. and Santos, F.M. (2002), "Knowledge-based view: a new theory of strategy?", in Pettigrew, A., Thomas, H. and Whittington, R. (Eds), *Handbook of Strategy and Management*, Sage Publications, Thousand Oaks, CA, pp. 139-164.

Este, J.A. and Cihlar, T. (2010), "Current status and challenges of antiretroviral research and therapy", *Antiviral Research*, Vol. 85 No. 1, pp. 25-33.

Finkel, S. (1995), *Causal Analysis With Panel Data. Quantitative Applications in the Social Sciences No. 105*, Sage Publications, Thousand Oaks, CA.

Grant, R. (1996), "Toward a knowledge-based theory of the firm", *Strategic Management Journal*, Vol. 17, Winter, pp. 109-122.

Hatch, N. and Dyer, J. (2004), "Human capital and learning as a source of sustainable competitive advantage", *Strategic Management Journal*, Vol. 25 No. 12, pp. 1155-1178.

Helfat, C. and Peteraf, M. (2003), "The dynamic resource-based view: capability lifecycles", *Strategic Management Journal*, Vol. 24 No. 10, pp. 997-1009.

Henderson, R. and Cockburn, I. (1994), "Measuring competence? Exploring firm effect in the pharmaceutical industry", *Strategic Management Journal*, Vol. 15 No. S1, pp. 63-84.

Hoopes, D., Madsen, T. and Walker, G. (2003), "Guest editor's introduction to the special issue: why is there a resource-based view? Toward a theory of competitive advantage", *Strategic Management Journal*, Vol. 24 No. 10, pp. 889-902.

Huber, G. (1991), "Organizational learning: the contributing processes and the literatures", *Organization Science*, Vol. 2 No. 1, pp. 88-115.

Hsiao, C. (2003), *Analysis of Panel Data*, Cambridge University Press, Cambridge.

King, A. and Zeithaml, C. (2003), "Competencies and firm performance: examining the causeal ambiguity paradox", *Strategic Management Journal*, Vol. 22 No. 1, pp. 75-99.

Kogut, B. and Zander, U. (1992), "Knowledge of the firm, combinative capabilities, and the replication of technology", *Organizational Science*, Vol. 3 No. 3, pp. 383-397.

Kraaijenbrink, J., Spender, J. and Groen, A. (2010), "The resource- based view: a review and assessment of its critiques", *Journal of Management*, Vol. 36 No. 1, pp. 349-372.

McEvily, S. and Chakravarthy, B. (2002), "The persistence of knowledge-based advantage: an empirical test for product performance and technological knowledge", *Strategic Management Journal*, Vol. 23 No. 10, pp. 935-952.

McGahan, A. and Victer, R. (2010), "How much does home country matter to corporate profitability?", *Journal of International Business Studies*, Vol. 41 No. 1, pp. 142-165.

Mahoney, J. and Pandian, J.R. (1992), "The resource-based view within the conversation of strategic management", *Strategic Management Journal*, Vol. 13 No. 5, pp. 25-45.

Markman, G., Espina, M. and Phan, P. (2003), "Patents as surrogates of inimitable and non-substitutable resources", *Journal of Management*, Vol. 30 No. 4, pp. 529-544.

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

Nelson, R. and Winter, S. (1985), "Forces generating and limiting concentration under schumpeterian competition", *The Bell Journal of Economics*, Vol. 9 No. 2, pp. 524-549.

Newbert, S. (2007), "Empirical research on the resource-based view of the firm: an assessment and suggestions for future research", *Strategic Management Journal*, Vol. 28 No. 2, pp. 121-146.

Newbert, S. (2008), "Value, rareness, competitive advantage, and performance: a conceptual-level empirical investigation of the resource-based view of the firm", *Strategic Management Journal*, Vol. 29 No. 7, pp. 745-768.

Nonaka, I. and Takeuchi, I. (1995), *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*, Oxford Press, Oxford.

Nonaka, I. and Von Krogh, G. (2009), "Perspective: tacit knowledge and knowledge conversion", *Organization Science*, Vol. 20 No. 3, pp. 636-652.

Patel, P. and Pavitt, K. (1994), "National innovation systems: why they are important, and how they might be measured and compared", *Economics of Innovation and New Technology*, Vol. 3 No. 1, pp. 77-95.

Peteraf, M.A. (1993), "The cornerstones of competitive advantage: a resource-based view", *Strategic Management Journal*, Vol. 14 No. 3, pp. 179-191.

Peteraf, M. and Barney, J. (2003), "Unraveling the resource-based tangle", *Managerial and Decision Economics*, Vol. 24 No. 4, pp. 309-323.

Polanyi, M. (1966), *The Tacit Dimension*, The University of Chicago Press, Chicago, IL.

Polidoro, F. and Toh, P. (2010), "Letting rivals come close or warding them off? The effects of substitution threat on imitation", *Academy of Management Journal*, Vol. 54 No. 2, pp. 369-392.

Powell, T. (2001), "Competitive advantage: logical and philosophical considerations", *Strategic Management Journal*, Vol. 22 No. 9, pp. 875-888.

Priem, R. and Butler, J. (2001), "Is the resource- based "view" a useful perspective for strategic management research?", *Academy of Management Review*, Vol. 26 No. 1, pp. 22-40.

Reuben, B. and Wittcoff, H. (1989), *Pharmaceutical Chemicals in Perspective*, Wiley-Interscience, New York, NY.

Rivkin, J. (2000), "Imitation of complex strategies", *Management Science*, Vol. 46 No. 6, pp. 824-844.

Rosenberg, N. (1976), *Perspectives on Technology*, Cambridge University Press, Cambridge.

Rouse, M. and Daellenbach, U. (2002), "More thinking on research methods for the resource-based perspective", *Strategic Management Journal*, Vol. 23 No. 10, pp. 963-967.

Schumpeter, J. (1934), *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*, Oxford University Press, London.

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

Teece, D. (1977), "Technology transfer by multinational firms: the resource cost of transferring technological know-how", *Economic Journal*, Vol. 87, June, pp. 242-261.

Teece, D. (1986), "Profiting from technological innovation: implication for integration, collaboration, licensing and public policy", *Research Policy*, Vol. 15 No. 6, pp. 285-305.

Teece, D. (2000), *Managing Intellectual Capital*, Oxford University Press, Oxford.

Wernerfelt, B. (1984), "A resource-based view of the firm", *Strategic Management Journal*, Vol. 5 No. 3, pp. 171-180.

Wiklund, J. and Shepherd, D. (2003), "Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium-sized businesses", *Strategic Management Journal*, Vol. 24 No. 13, pp. 1307-1314.

Williamson, O. (1985), "Transaction cost economics: the comparative contracting perspective", *Journal of Economic Behavior & Organization*, Vol. 8 No. 4, pp. 617-625.

Winter, S. (1987), "Knowledge and competence as strategic assets. The competitive challenge", in Teece, D.J. (Ed.), *Strategies for Industrial Innovation and Renewal*, Ballinger, Cambridge, MA, pp. 159-184.

Zahra, S. and George, G. (2002), "Absorptive capacity: a review, reconceptualization, and extension", *Academy of Management Review*, Vol. 27 No. 2, pp. 185-203.

Further reading

Wang, H., He, J. and Mahoney, J. (2009), "Firm-specific knowledge resources and competitive advantage: the roles of economic and relationship-based employee governance mechanisms", *Strategic Management Journal*, Vol. 30, pp. 1265-1285.

About the author

Dr Rogerio Victer is an Assistant Professor in Strategic Management at the Fairleigh Dickinson University, USA. He has a DBA Degree in Strategy and Policy from the Boston University and an MBA Degree from the Boston College. Dr Rogerio Victer can be contacted at: rvicter@fdu.edu