



How knowledge assets lead to a sustainable competitive advantage: are organizational capabilities a missing link?

Karim Moustaghfir

Al Akhawayn University in Ifrane, Morocco

Correspondence: Karim Moustaghfir,
Al Akhawayn University in Ifrane,
Avenue Hassan II, P.O. Box 104, 53000
Ifrane, Morocco.

Tel: + 212 (0) 5 358 621 43;

Fax: + 212 (0) 5 358 629 77;

E-mail: K.Moustaghfir@ai.ma

Abstract

Even though knowledge assets have been widely recognized as the principal drivers of firm's competitive advantage, few are the frameworks that have explained how these strategic assets are transformed into value and how the value creation process occurs. Also there is a confusing terminology in the literature surrounding many concepts explaining the dynamics of value creation. By conducting a Systematic Review – an evidence-based methodology for theory building – this paper seeks to define a 'common language' of the concepts used to explain this phenomenon, and build the assumptions of a theoretical model that explains how knowledge assets, through learning mechanisms, are linked, renewed, and leveraged into socio-technical processes or organizational routines, that in turn form the basis of organizational capabilities. As they are socially constructed, these organizational capabilities, when leveraged into products and services, generate value and provide firms with a sustainable competitive advantage and long-term superior performance. The model should therefore serve as a theoretical contribution to the literature and it has a further potential benefit to begin an inquiry, for both theory building and management, about the nature of firm's knowledge assets and organizational capabilities, and the sources of sustainable competitive advantage. Some of these avenues are outlined in this paper.

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Introduction

The central premise of the resource-based view of the firm is to explain why firms differ and how it matters (Wernerfelt, 1984; Barney, 1991; Nelson, 1991; Hoopes *et al.*, 2003). Over more than 15 years scholars of the resource-based view have tried to answer this major research question, asserting that rival firms compete on the basis of the heterogeneity and immobility of their resources (Wernerfelt, 1984; Dierickx & Cool, 1989; Barney, 1991, 2001; Amit & Schoemaker, 1993; Peteraf & Bergen, 2003). Indeed, it is suggested that resources which are valuable, rare, inimitable, and non-substitutable are used to implement value-creating strategies, and consequently provide firms with a sustainable competitive advantage (Barney, 1991; Grant, 1991, 1996a, b).

However, the concept of 'resources' has been used in all-encompassing ways to include almost any firm attribute (Priem & Butler, 2001). Dosi *et al.* (2000) highlight correctly the 'terminology soup' we are facing in the

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resource-based theory literature regarding concepts such as resources and capabilities (Teece, 2005). According to Grant (1991), 'resources are inputs into the production function – they are the basic units of analysis. A capability is the capacity of a team of resources to perform some task or activity'. A firm's resources are either tangible or intangible (Helfat & Peteraf, 2003). The intangibility of resources make them unobservable, and hence strategic to the firm (Michalisin *et al.*, 1997).

The concept of 'knowledge assets' has emerged in the literature to refer to these intangible resources (Boisot, 1998; Teece, 1998, 2000). Knowledge assets include a firm's intellectual assets, and employees' skills and know-how (Hall, 1993), and they are difficult to imitate because of their characteristics (Teece, 1998). Also, a firm's knowledge assets interact with each other (Barney, 2001), generate, renew and arise from experience (Nonaka *et al.*, 2000a), and support the firm's processes and activities over time (Helfat & Raubitschek, 2000). In fact, knowledge assets are leveraged into a firm's capabilities which in turn shape its products and services, and consequently impact performance (Grant, 1991, 1996b; Rouse & Daellenbach, 2002).

However, even though many scholars recognize the value of knowledge assets, the link between these unique attributes and firm profitability remains unclear (Foss, 1997). Grant (2005) claims that research on knowledge asset management offers a tremendous potential both in focusing managers' attention on what is important, and in forging linkages between the human and knowledge resources of the firm and the organizational capabilities that drive superior performance. In fact, until now prior research has given little guidance of how knowledge assets interact with each other. Questions arising include: How are knowledge assets enhanced and renewed over time? How do knowledge assets interact with each other? How do knowledge assets shape organizational capabilities, and how do these in turn impact on a firm's profitability and provide it with a sustainable competitive advantage?

The aim of this paper is to create an integrative theoretical model that explains how knowledge assets provide firms with a sustainable competitive advantage, using organizational capabilities as an intermediate construct. We therefore provide the theoretical foundations of 'knowledge assets' and 'organizational capabilities', and shed more light on the assumptions underpinning their interdependencies. We also explore the concept of 'sustainable competitive advantage' and show how organizational capabilities have the potential to provide a firm with long-term superior performance. For the purposes of this research, we conducted a systematic literature review (Tranfield *et al.*, 2003) which is a recognized evidence-based tool for theory building (Leseure *et al.*, 2004; Pittaway *et al.*, 2004).

The remainder of this paper is organized as follows. First, we explain the methodological aspects related to the systematic review. We then build the theoretical

model, which we developed as a result of the systematic review, by discussing the theoretical foundations of the different concepts, and by identifying the main propositions underpinning their relationships and interdependencies. Finally, we discuss the predominant issues that arise from the theoretical model, before outlining the main implications of the research, and the directions for future research.

Systematic review method

Traditional 'narrative' reviews often lack rigor, and in many cases are not undertaken as genuine pieces of investigatory science. For the purposes of this research we therefore drew on the systematic review process. This process was first developed in the medical science to produce a replicable, scientific, and transparent analysis of the literature (Cook *et al.*, 1997). The systematic review follows a detailed process, with the aim being to minimize bias through exhaustive literature searches of published and unpublished studies, and to provide an audit trail of the reviewers' decisions, procedures, and conclusions. In their seminal paper Tranfield *et al.* (2003) were the first to recommend the value of the systematic review methodology in management research, in order to produce transparent, high-quality, and relevant reviews of the literature supported by documented evidence.

We followed the methodology outlined by Tranfield *et al.* (2003) to ensure that a methodological, transparent, and replicable review of the literature was undertaken. The literature review was scoped on the basis of a carefully defined research question, which allowed us to delimit the search by factors such as the disciplinary perspective, and keywords, as well as the quality of the research sources.

After identifying the research question a consultation panel was formed with eminent academics familiar with the literature in the relevant fields. In dialogue with the consultation panel, the field for this literature review was mapped out and keywords and inclusion criteria were developed for the review. The keywords were generated based on the experience of the research team and the consultation panel members, as well as the literature related to the identified fields. In order to ensure transparency a review protocol was kept to document all relevant decisions.

The selected keywords (see Table 1) were then constructed into a set of search strings (see Table 2), which were used to conduct searches in electronic journal databases (see Table 3). For the purposes of this study, only scholarly articles published in English language since 1985 were included (see Table 4). The review followed a number of stages to provide a systematic and explicit method, including the planning of the review (i.e., forming the consultation panel, mapping the field of the study, and producing a review protocol), identification and the evaluation of articles (i.e., conducting a systematic article search, evaluating articles), extraction

Table 1 Search keywords

1. Knowledge economy	2. Knowledge-based economy	3. Resource-based view
4. Resource-based theory	5. Knowledge-based view	6. Knowledge-based theory
7. Knowledge assets	8. Intangible assets	9. Invisible assets
10. Intellectual capital	11. Knowledge strategy	12. Knowledge processes
13. Knowledge management strategy	14. Knowledge management processes	15. Knowledge management systems
16. Knowledge management practices	17. Organizational learning	18. Organizational routines
19. Dynamic capability (or capabilities)	20. Absorptive capacity	21. Combinative capabilities
22. Core competence (or competences)	23. Competitive advantage	24. Business performance
25. Firm performance	26. Value creation	

Table 2 Search strings

1. Knowledge economy OR knowledge-based economy	2. Resource-based AND view OR theory	3. Knowledge-based AND view OR theory
4. Knowledge assets	5. Intangible assets OR invisible assets	6. Intellectual capital
7. Knowledge strategy OR knowledge process*	8. Knowledge management AND strategy OR process* OR system* OR practices	9. Organizational learning OR organizational routines
10. Dynamic capability OR dynamic capabilities	11. Absorptive capacity OR combinative capabilities	12. Core competence*
13. Sustained competitive advantage OR sustainable competitive advantage	14. Business performance OR firm performance AND (resources OR knowledge assets OR intangible assets OR intellectual capital OR knowledge management OR organizational learning OR absorptive capacity OR core competence*)	15. Value creation AND (resources OR knowledge assets OR intangible assets OR intellectual capital OR knowledge management OR organizational learning OR absorptive capacity OR core competence*)

*Truncation symbol; ?Wildcard symbol.

Table 3 Journal Databases

Database	Areas	Truncation symbol e.g. <i>educat*</i>	Wildcard symbol e.g. <i>organi?ation</i>	Phrase searching
ABI Proquest	This database includes details on virtually every aspect of business and management from 1986.	*	?	Two or more words default to a phrase
EBSCO Business Source Premier	This database is the world’s largest full text database for scholarly business journal and peer-reviewed publications, including virtually all subject areas related to business.	*	?	Two or more words default to a phrase
Emerald	Emerald publishes the world’s widest range of business and management journals allowing access to the latest research and global thinking.	*	Not available	Enclose phrases in double quotes
Wiley Interscience	This database contains some of the finest full text business and management journals around the globe.	*	Not available	Two or more words default to a phrase

*Truncation symbol; ?Wildcard symbol.

and data synthesis, and reporting of the findings (see Table 5).

The initial search using the specified keyword strings resulted in 6917 papers being identified. The abstracts of these papers were then assessed using the inclusion and exclusion criteria, to determine their relevance with regard to the purpose of the systematic review. Following the initial assessment 381 papers were deemed to be relevant and of suitable quality to be read in full and analyzed further. Other 24 articles were recommended by the consultation panel and identified in other

information sources (e.g., books, book chapters etc.). A total of 405 articles were peer-reviewed according to a rigorous question-based appraisal tool (Popay & Williams, 1998) (see Table 6). At the end of this quality assessment phase 146 articles were deemed to be of sufficient quality and relevance to the study (see Table 7). A descriptive analysis of each article was conducted and the results were stored using a pre-defined workflow template (see Table 8). Finally, a ‘grounded theory’ approach was used to build higher-order theoretical constructs and the assumptions underpinning their

Table 4 Inclusion and exclusion criteria

No.	Criteria	Reason for inclusion or exclusion
<i>Inclusion criteria</i>		
1	Published papers/articles since 01/01/1985	The main contributions to the theoretical concepts that we intend to explore started to be published after 1985.
2	Papers/articles in English language	The language in which the main scholarly business journals are published is English.
3	Papers/articles that aim to understand each of the studied constructs	This matches with the first objective of this review to understand the meaning of each theoretical concept.
4	Papers/articles that treat the relationships between two or more of the studied constructs	This matches with the second objective of this review to show the interdependencies and the relationships between the different theoretical concepts.
5	Papers/articles that address strategy issues	The main theoretical contributions related to the studied concepts have been made by strategic management scholars.
6	Scholarly published papers/articles	To provide more rigorous arguments and theoretical foundations for the propositions and assumptions that the review intend to develop.
<i>Exclusion criteria</i>		
1	Papers/articles focused on financial accounting, economics, pure disclosure purposes	These are not concepts that we intend to explore and the papers/articles treating them will not provide meaningful insights as regards to the purpose of the review.
2	Practitioner papers/articles with no theory	The contribution of these papers/articles is irrelevant to the purpose of this review.

Table 5 Systematic review stages

1	Planning the review, forming the consultation panel, and producing the review protocol.
2	The review team has identified keywords based on their prior experience, the literature related to each construct and in discussion with the members of the consultation panel.
3	The keywords were constructed into 15 search strings.
4	The five databases chosen were reviewed using the search strings identified in step 3.
5	The papers identified were reviewed using the inclusion and exclusion criteria. Two stages were undertaken to reduce the number of articles/papers, the first to analyze titles according to the exclusion criteria and the second to analyze abstracts according to the inclusion criteria.
6	The retained papers were imported from databases into <i>Procite</i> , downloaded in full text format and peer-reviewed by the review team according to the quality assessment criteria based on a 'question'-oriented appraisal tool.
7	The papers relevant to the study were stored in a <i>Procite</i> database with a descriptive analysis. The other information sources and the papers recommended by the members of the consultation panel and not included previously were added to the database with a descriptive analysis.
8	Grounded Theory Method was used to synthesize the gathered information, to build on it to generate the assumptions underpinning the relationships between the studied constructs, and develop the foundations of a theoretical model.

relationships (Glaser & Strauss, 1967). We therefore followed an inductive process based on a comparative analysis to synthesize the gathered information, build on it in order to emphasize the meaning of each concept, and then develop the propositions underpinning the relationships between the studied constructs, which in turn form the foundations of the theoretical model discussed in the following section.

Creating the theoretical model

In what follows we discuss the findings of the systematic review. Specifically, we create an integrative model that links knowledge assets with sustainable competitive advantage. We define each construct in turn, outline

the relationships between constructs, and draw up the different propositions underpinning the theoretical model.

Knowledge dynamics in the firm

In this part, we define the theoretical foundations of knowledge assets, organizational learning, and knowledge management, show how knowledge assets interact with each other, how they are linked, converted, and renewed over time through organizational learning mechanisms, and describe how knowledge management processes support these interdependencies or knowledge dynamics.

Table 6 Question oriented appraisal tool

1	Was an explicit account of the theoretical framework given?
2	Is there a succinct statement of objectives or research questions?
3	Is there a clear description of the context?
4	How was the sample chosen, is it adequate?
5	Was there a clear description of data analysis methods, were they appropriate?
6	How does the research move from the raw data (numbers, quotations or examples) to an analysis and interpretation of the meaning and significance of it?
7	Are the findings relevant to policy/practice, do they provide guidance for future research?

Table 7 Search results, reviewed papers, and included papers

Search strings	Search results from journal databases	Relevant papers to be reviewed	Included papers
Knowledge economy OR knowledge-based economy	228	10	5
Resource-based AND view OR theory	445	92	44
Knowledge-based AND view OR theory	278	17	4
Knowledge assets	63	11	5
Intangible assets OR invisible assets	428	21	5
Intellectual capital	447	22	6
Knowledge strategy OR knowledge process*	99	8	0
Knowledge management AND strategy OR process* OR system* OR practices	1309	61	7
Organizational learning OR organizational routines	2419	64	6
Dynamic capability OR dynamic capabilities	81	27	21
Absorptive capacity OR combinative capabilities	92	8	2
Core competence*	135	8	3
Sustained competitive advantage OR sustainable competitive advantage	520	22	15
Business performance OR firm performance AND (resources OR knowledge assets OR intangible assets OR intellectual capital OR knowledge management OR organizational learning OR absorptive capacity OR core competence*)	306	7	0
Value creation AND (resources OR knowledge assets OR intangible assets OR intellectual capital OR knowledge management OR organizational learning OR absorptive capacity OR core competence*)	67	3	0
<i>Sub-total</i>	6917	381	123
Consultation Panel	—	6	6
Other Information Sources	—	18	17
<i>Total</i>	6917	405	146

Knowledge assets

In the strategic management literature the concept of 'resources' has been used in an all-inclusive manner to include any firm attribute (Priem & Butler, 2001). In fact, Wernerfelt (1984) considers a resource to be anything which could be thought of as a strength or weakness of a given firm and may include, for example, brand names, in-house knowledge of technology, employment of skilled personnel, trade contacts, machinery, efficient procedures, capital etc. Similarly, Barney (1991) assumes that a firm's resources include all assets, capabilities, organizational processes, firm attributes, information, knowledge etc. However, a first distinction must be made between 'resources' and 'capabilities'. On one hand, a resource is an observable (but not necessarily tangible) asset that can be valued and traded. A capability, on the

other hand, is not observable (and hence intangible), is enacted by a mixture of people and practices, cannot be valued, and can only be transferred as part of its entire unit (Hoopes *et al.*, 2003). According to Amit & Schoemaker (1993), capabilities are not part of 'resources' because of their dynamic 'doing' nature, they are the result of resource deployment and organizational processes. Indeed, the firm's resources are defined as stocks of available factors that are owned or controlled by the firm. However, capabilities use resources, and hence, they are dynamic and complex entities and should be treated separately to resources (Amit & Schoemaker, 1993). Therefore, a resource is an elementary entity which the firm controls in order to best organize its production process. A person, machine, piece of knowledge, brand image, and patent can all be regarded as resources

Table 8 Workform for descriptive analysis

1	Author(s)
2	Title
3	Document name
4	Journal title
5	Research question
6	Key findings/contribution
7	Date of publication
8	Volume
9	Month or season
10	Part
11	Page numbers
12	Empirical (Quantitative/Qualitative)/Theoretical
13	Theory testing vs Theory building
14	Theoretical grounding (none/limited/good/very good)
15	Methodology (data collection)
16	Methodology (data analysis)
17	Sample size
18	Industry context
19	Country context
20	Focus/Definitions
21	Academic vs Practitioner
22	Practical implications
23	Synopsis/Summary
24	Database
25	Location of item
26	Include yes/no
27	Reason for exclusion
28	Notes
29	Abstract
30	Discipline/field of research
31	Keywords

(Moingeon *et al.*, 1998). Also, Grant (1991) argues that 'resources are inputs into the production function – they are the basic units of analysis. A capability is the capacity of a team of resources to perform some task or activity'.

A firm's resources are either tangible or intangible (Helfat & Peteraf, 2003). On one hand, tangible resources refer to the fixed and current assets of an organization that have a fixed long-run capacity (Hall, 1992). Examples include plants, equipment, land, other capital goods and stocks, debtors and bank deposits. On the other hand, intangible resources can be classified as 'assets' or 'competences' (Hall, 1993). Intangible assets include the intellectual property rights in form of patents, trademarks, copyright and registered designs, contracts, trade secrets and databases, as well as the firm's reputation. Competences, however, include the know-how of employees, and the collective attributes which add up to organizational culture (Hall, 1992, 1993). Intangibility is an important characteristic of strategic resources, since intangible resources are state unobservable and thus difficult to imitate (Michalisin *et al.*, 1997).

The concept of 'knowledge assets' has emerged in the literature to refer to this set of intangible resources (Teece, 1998, 2000; Nonaka *et al.*, 2000a, b). In effect, knowledge assets are considered as firm-specific resources that are

difficult, if not impossible, to imitate (Teece, 1998). Such assets are difficult to transfer among firms because of transaction costs and transfer costs, and because the assets may contain tacit knowledge. Nonaka *et al.*, (2000b) define knowledge assets as 'firm-specific resources that are indispensable to create value for the firm'. Indeed, knowledge assets are the inputs, outputs, and moderating factors of the organization's knowledge creating activities, and hence they are constantly evolving.

Even though knowledge assets are recognized as potential value enhancers (Hall, 1992; Nahapiet & Ghoshal, 1998; Hitt *et al.*, 2001), they cannot directly impact profitability or confer a sustainable competitive advantage. In fact, knowledge assets are seen as intangible resources (i.e., inputs) or stocks of available factors, that are owned or controlled by the firm (Dierickx & Cool, 1989; Amit & Schoemaker, 1993), that support its capabilities, activities, and products (Helfat & Raubitschek, 2000), which in turn are transformed into profitability.

This brings us to develop the following proposition:

Proposition 1: *Knowledge assets are the knowledge-based intangible resources a firm controls, which support its capabilities and activities, and facilitate the creation of products and services. Knowledge assets can take the form of employees' skills and know-how, intellectual capital, or intellectual property (e.g., patents, trademarks, copyrights and registered designs, contracts, trade secrets and databases).*

Teece (1998) argues that 'the competitive advantage of companies in today's economy stems not from market position, but from difficult to replicate knowledge assets and the manner in which they are deployed'. In fact, knowledge assets represent the 'Crown Jewels' (Grant, 1991) of firms, and their strategic role to create value and improve business performance has incited organizations to invest heavily in methodologies, processes, and technologies to enrich, nurture, and renew them over time.

Organizational learning mechanisms

Kim (1993) defines the process of organizational learning as 'increasing an organization's capability to take effective action'. A core aspect of organizational learning is that it takes place over time, and hence can be directed towards the achievement of firm's performance (Garvin, 1993; Smith *et al.*, 1996). In fact, the primary aim of organizational learning is the continuous development of new knowledge, as well as the nurturing and enhancement of the existing knowledge assets (Fiol & Lyles, 1985; Pemberton & Stonehouse, 2000).

A distinction is made between enabling organizational learning and its production (Argyris & Schön, 1978). Enabling organizational learning includes group,

inter-group, and organizational features such as policies, practices, rules, and organizational memory. Producing organizational learning, however, is performed by individuals taking action. Lei *et al.* (1996) state that successful organizational learning depends on the acquisition and assimilation of diverse new bases of knowledge for subsequent actions. A distinction is made between higher-level and lower-level organizational learning as well (Lei *et al.*, 1996). Higher-level organizational learning involves the formation and use of heuristics and insights that help the organization define and solve highly ambiguous problems, it is often associated with double-loop learning, which is related to examining and changing the fundamental state of the organization (Argyris & Schön, 1978). In contrast lower-level organizational learning generally involves the repetition of past behaviors, with few associations being formed. These patterns are consistent with the notion of single-loop learning, in which there is no systematic attempt to change underlying policies or values (Argyris & Schön, 1978).

As an organization's performance is based on its employees' individual knowledge (Savage, 1990), as well as the collective knowledge of the organization (Von Krogh *et al.*, 1994), firms are thriving to become learning organizations, as such pursuing the objective of continuous development of their knowledge assets (Senge, 1990). The importance and strategic role of knowledge assets has led to the definition of concepts, approaches, and tools to make knowledge assets an identifiable and manageable resource. Knowledge management processes have been developed as the practices that allow organizations to maintain and grow their knowledge assets.

Knowledge management processes

Knowledge management is not only about managing knowledge, but also about changing organizational culture to one that values learning and sharing, and hence, it is concerned with facilitating the organizational learning process (Korac-Kakabadse *et al.*, 2002). Teece (2000) defines knowledge management as 'the panoply of procedures and techniques used to get the most from a firm's knowledge assets'. In this sense, two objectives of knowledge management can be identified: (i) to make the organization act as intelligently as possible in order to secure its viability and overall success; and (ii) to maximize the value of its knowledge assets (Demarest, 1997; Wiig, 1997). Korac-Kakabadse *et al.*, (2002) identify five generic knowledge management strategies: (1) knowledge identification, the process of becoming aware, locating and recognizing knowledge that is held or lacking within an organization, and which is relevant to the organization and marketplace; (2) knowledge leverageability/diffusion, the process of using what organizations know, and spreading knowledge throughout the organization and to targeted external parties such as customers or regulators; (3) knowledge replication through the firm's operations and activities;

(4) knowledge generation/innovation, the process of creating new knowledge within an organization, whether through traditional R&D or via the linking of previously separate information, such as customer's needs and technological capabilities; and finally (5) knowledge commercialization, the organizational knowledge that can be sold.

A core aspect of knowledge management theories is the identification of processes used by organizations to increase the value of their knowledge assets (Zack, 1999). In fact, Wiig (1997) defines knowledge management as the process to understand, focus on and systematically, explicitly, and deliberately manage knowledge in order to build, renew and apply knowledge. Similarly, Boisot's (1998) I-Space framework considers the following three fundamental processes for managing knowledge: codification, abstraction, and diffusion. Generally, knowledge management processes encompass three primary activities: knowledge generation, the way employees and organizations innovate; knowledge integration, how employees transform their tacit knowledge into explicit knowledge by codifying their ideas into the systems of the organization; and knowledge sharing, the socialization process through which employees share knowledge with one another (Nonaka *et al.*, 2000b).

Knowledge dynamics

Many scholars have emphasized the interconnectivity of a firm's knowledge assets and their evolution over time (Nonaka *et al.*, 2000b). Scholars supporting the resource-based view consider the firm as a bundle of resources or assets in which the different assets depend on each other to create value (Wernerfelt, 1984; Dierickx & Cool, 1989; Peteraf, 1993; Barney, 2001; Makadok, 2003). Conner (1991) suggests that within firms 'hierarchies' of resources may exist. Elementary resources such as individuals' know-how may contribute to the creation of another, more aggregate level of resources such organizational culture, which may contribute to another even more aggregate level such as company reputation. Firms are involved in actively accumulating resources to enhance their dynamic distinctiveness or resource synergies (Mathews, 2003). This suggests that knowledge assets are bundles of linked idiosyncratic resources that are enhanced, renewed, and nurtured over time through resource conversion activities (Rumelt, 1984; Conner, 1991; Smith *et al.*, 1996), which make them dynamic in nature (Roos & Roos, 1997; Schiuma *et al.*, 2007).

The knowledge stock needs to flow through learning processes (McGaughey, 2002) in order to be created, renewed, and leveraged (Wiig, 1997; Crossan *et al.*, 1999). While learning flows can be adjusted instantaneously, knowledge stocks cannot. It takes learning processes and learning flows to accumulate a desired change in strategic asset stocks. The interaction of knowledge assets with each other in order to create new knowledge and maintain the value of knowledge stocks is facilitated through different organizational learning mechanisms

and knowledge management processes (Schiuma & Carlucci, 2007). Knowledge assets have their foundation in data, information, and learning processes that are often organization specific (McGaughey, 2002). Knowledge creation is the final result of the learning process (Nonaka *et al.*, 2000a), and conversely, learning occurs when knowledge is created, shared, and used.

This establishes the link between knowledge and learning process. In fact, not only is the primary aim of organizational learning the continuous development of new knowledge, but also the more efficient and effective management of the resulting organizational knowledge through knowledge management processes (Pemberton & Stonehouse, 2000; Schiuma *et al.*, 2008). Put differently, while organizational learning generates new knowledge, the knowledge management discipline takes the output, manages it effectively and efficiently, and ensures that an appropriate environment is maintained to perpetuate the generation and management of knowledge assets (Smith *et al.*, 1996; Nonaka *et al.*, 2000a). Hence, knowledge management is recognized as the fundamental activity for obtaining, growing, and sustaining knowledge assets in organizations, and the successful management of knowledge assets is closely linked to the knowledge management processes an organization has in place (Wiig, 1997).

In summary, knowledge assets interact with each other and their creation depends on organizational learning mechanisms and knowledge management processes. We refer to this as *knowledge dynamics* (Figure 1) and synthesize it into the following propositions:

Proposition 2a: *A firm's knowledge assets depend upon, and interact with, each other over time. This interconnectivity is enabled by organizational learning mechanisms, which permit firms to leverage and renew their knowledge assets.*

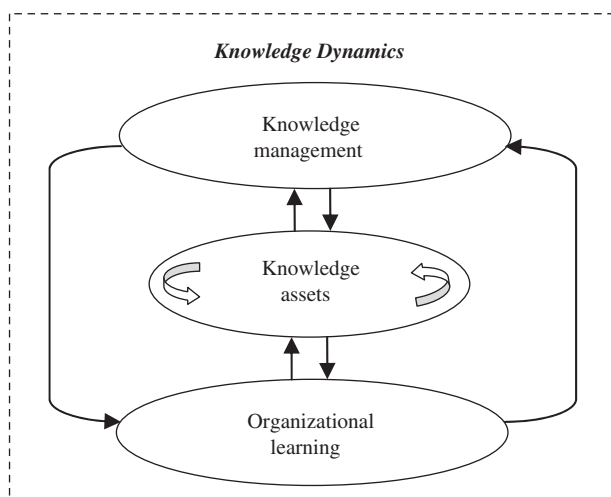


Figure 1 Knowledge dynamics.

Proposition 2b: *Knowledge management processes support organizational learning mechanisms in creating, renewing, and managing knowledge assets.*

Organizational capabilities

In this part of the paper, we discuss how different knowledge assets are integrated into socio-technical processes or organizational routines, which in turn shape organizational capabilities. We explain the role of absorptive capacity in facilitating this integration process. We then define the concept of organizational capabilities, making a distinction between operational capabilities and dynamic capabilities.

Knowledge dynamics, organizational routines, and the role of absorptive capacity in developing organizational capabilities

It is widely recognized that knowledge is a resource that supports firm capabilities, activities, and products, and that it arises from learning and experience (Long & Vickers-Koch, 1995; Mahoney, 1995; Lei *et al.*, 1996; Helfat & Raubitschek, 2000; Murray & Donegan, 2003). New knowledge created in the process of organizational learning is integrated into organizational capabilities (Grant, 1991, 1996a, 1996b; Pemberton & Stonehouse, 2000). In fact, Dosi *et al.* (2000) state that some aspects of knowledge management clearly relate to improving capabilities through learning. While knowledge assets are grounded in the experience and expertise of individuals, firms provide the physical and social structure, and resource allocation decisions, so that knowledge can be shaped into capabilities. The essence of the firm is to then create, assemble, transfer, integrate, and exploit knowledge assets that underpin its capabilities (Tece, 1998, 2000). A firm's capabilities are therefore seen as a combination of all knowledge assets and cognitive processes that allow it to perform its operations (Pehrsson, 2000; Montealegre, 2002; Miller, 2003). McGrath *et al.* (1995) suggest that 'comprehension' and 'deftness' are fundamental, precursor, processes to the establishment of capabilities. Comprehension is the outcome of a process by which elements of individual know-how and skills become linked, and deftness is a quality in a group which permits heedful interactions to be conducted at minimal cost.

Dosi *et al.* (2000), assume that organizational learning mechanisms produce the coordinated performance of organizational capabilities. They argue that an organization produces coordinated activities without anyone knowing about how they work, and as learning proceeds, innumerable procedural details are settled by individual participants, with or without conscious awareness or consideration (Dosi *et al.*, 2000). Hence, capabilities are developed based on sequences of path dependent learning (Miller, 2003). Similarly, Iansiti & Clark (1994) purport that a firm's ability is based on its capabilities, which stem from the firm's knowledge base, that is

knowledge assets, and that problem solving as a learning mechanism is the principal driver in generating new capabilities. Further, Kogut & Zander (1992) state that organizations have the possibility to create new capabilities by a process of trial-and-error learning. The learning organization is one that can translate the learning of individual members or individual business units into something that belongs to an organization as a whole – into its organizational capabilities (Mathews, 2003).

To understand the anatomy of a firm's capabilities, Nelson & Winter's (1982) concept of 'organizational routines' is illuminating (Grant, 1991). Nelson (1991) asserts that firm's capabilities, together with their specific organizational routines, are the result of an internal learning process. Organizational routines are considered to be the building blocks of the concept of organizational capabilities (Nelson, 1991). An organizational routine is a repetitive, recognizable pattern of interdependent actions, involving multiple actors (Feldman & Pentland, 2003). As such they are stable patterns of behavior that characterize organizational reactions to variegated, internal, and external stimuli (Nelson & Winter, 1982; Zollo & Winter, 1999, 2002).

Routines are seen as an important part of organizational learning (Feldman & Pentland, 2003). Zander & Kogut (1995) claim that the codification of the experience gained through repeated practice into technology and formal procedures makes that experience easier to apply and accelerates the building of routines. According to Teece *et al.* (1997), when firm-specific assets are assembled into integrated clusters spanning individuals and groups so that distinctive activities can be performed, the activities constitute organizational routines. Organizational routines, shaped by the firm's positions, knowledge assets, and molded by its evolutionary and co-evolutionary paths, explain the essence of capabilities (Teece & Pisano, 1994). Hence, organizational learning mechanisms allow a firm to capitalize on a capability, through acquiring, enriching, and renewing organizational routines that in turn form the firm's organizational capabilities (Moingeon *et al.*, 1998). In fact, through organizational learning and knowledge management processes, a firm's knowledge assets are bundled, linked, incorporated, converted, and organized into socio-technical processes, organizational routines, that then form its organizational capabilities (Rouse & Daellenbach, 2002; Schroeder *et al.*, 2002).

In addition, developing capabilities is not simply a matter of assembling a set of resources. Indeed, capabilities involve complex patterns of coordination between people, and between people and other resources, hence perfecting such coordination requires learning through repetition (Grant, 1991; Roos & Roos, 1997; Marsh & Stock, 2003).

Some scholars describe how a firm's capabilities evolve over time. Zollo & Winter (1999, 2002), for example, state that capabilities arise from learning mechanisms that include experience accumulation, knowledge articula-

tion, and knowledge identification. The capabilities then evolve according to a knowledge evolution cycle, as a series of stages in a recursive cycle that include generative variation, internal selection, replication, and retention phases (Zollo & Winter, 1999, 2002). Through the replication and retention phases knowledge becomes increasingly embedded in human behavior and is likely to improve in effectiveness while declining in abstraction and in explicitness (Zollo & Winter, 2002). In the same way, Helfat & Peteraf (2003) suggest that capabilities evolve in a life cycle fashion, which includes the stages of founding, development, and maturity. Once maturity is reached, the capability can branch into additional stages, including renewal, replication, redeployment, and recombination. These stages are what Teece (2005) calls 'orchestration', since the transformation at issue does not typically happen without managerial direction. Indeed, to understand how capabilities evolve the role of managerial cognitive representations, especially in constraining and directing learning efforts cannot be neglected (Tripsas & Gavetti, 2000).

Adaptation and change have also an impact on the evolution of organizational capabilities. In fact, as adaptation and change often require feedback from the external environment (e.g., customers, competitors, etc.), it can affect a firm's aspiration levels, that is firm's goals, which can affect learning and the evolution of capabilities (Helfat, 2000; Winter, 2000).

The ability of managers to value and assimilate new knowledge from their business environment, and then apply it to shape their organizational capabilities has been referred to as the firm's 'absorptive capacity' (Cohen & Levinthal, 1990; Zahra & George, 2002). Absorptive capacity is embedded in a firm's routines and processes, and is used to make it possible to assimilate external knowledge, analyze the stocks and flows of a firm's knowledge, that is knowledge dynamics, and consequently influence the ability to create and develop the knowledge necessary to build and shape organizational capabilities (Zahra & George, 2002). Thus, absorptive capacity is seen as a set of organizational routines and processes through which firms acquire, assimilate, transform, and exploit external knowledge to produce organizational capabilities (Cohen & Levinthal, 1990). The development of such a capacity depends on the exposure to diverse and complementary external sources of knowledge, experience, and the activation triggers that encourage or compel a firm to respond to specific internal or external stimuli (Nelson & Winter, 1982; Zahra & George, 2002).

This leads us to develop the following propositions (Figure 2):

Proposition 3a: *Knowledge assets, through different knowledge dynamics, are bundled, linked, incorporated, converted, organized, and integrated into socio-technical processes or organizational routines that form the basis of a firm's organizational capabilities.*

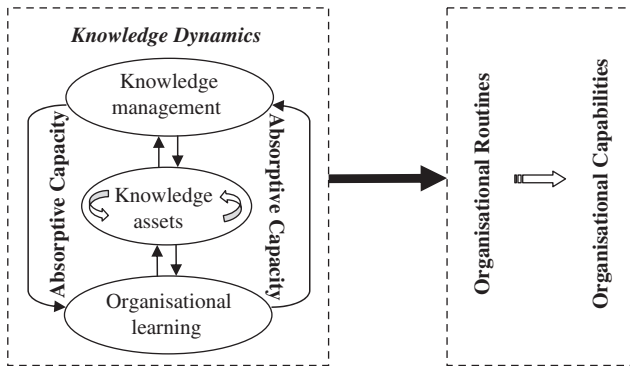


Figure 2 Knowledge dynamics and the development of organizational capabilities.

Proposition 3b: *The integration of knowledge into organizational capabilities is enabled by the firm's absorptive capacity, or its ability to assimilate and exploit new external knowledge.*

Organizational capabilities

The concept of 'organizational capabilities' has been widely used in the strategic management literature in all-encompassing ways with diverse terms and different meanings. According to Amit & Schoemaker (1993), 'capabilities' can be thought of abstractly as 'intermediate goods' generated by the firm to provide enhanced productivity of its final product or service. One of the original descriptions of the term 'capabilities' comes from Ansoff (1965) who describes it as a firm's ability to deal with different combinations of competitive environments and levels of 'entrepreneurial turbulence'. Richardson (1972) also used the term where he argued that 'organizations will tend to specialize in activities for which their capabilities offer some comparative advantage'.

A capability is a 'high-level routine (or collection of routines) that, together with its implementing input flows, confers upon an organization's management a set of decision options for producing significant outputs of a particular type' (Winter, 2000, 2003). The important properties of capabilities are their tacitness (Nonaka *et al.*, 2000b), context specificity (Nelson & Winter, 1982), and temporality (Dierickx & Cool, 1989). These properties in turn, have important consequences for developing, deploying, and renewing capabilities within an organization. An organizational capability refers then to the ability of an organization to repeatedly perform a coordinated set of tasks which relate either directly or indirectly to its ability to create value through transforming inputs into outputs (Grant, 1991; Collis, 1994; Helfat & Peteraf, 2003).

The concept of 'capabilities' has sometimes been used interchangeably with 'competences' (Von Krogh & Roos, 1995; Pehrsson, 2000; Ray *et al.*, 2004). SubbaNarasimha (2001) proposes the dictionary definition of the term

'competence' as 'having requisite or adequate ability or qualities' and he argues that 'competence' refers to 'capability for action'. Similarly, Von Krogh & Roos (1995) use the term 'competence' to denote the 'ability of the firm to act' and consider that competence is both knowledge specific and task specific. Also, Reed & DeFillippi (1990) define 'competence' as 'the particular skills and resources a firm possesses, and the superior way in which they are used'. A distinction can be made between 'component competence' and 'architectural competence' (Henderson and Cockburn, 1994). While component competence encompasses the local abilities, knowledge and skills that are fundamental to day-to-day problem solving, architectural competence represents the firm's ability to use these component competences to integrate them effectively, and hence could be treated as similar to an organizational capability. According to Stalk *et al.* (1992), 'competences and capabilities represent two different but complementary dimensions of an emergent paradigm for corporate strategy'. Whereas competences emphasize technological and production expertise at specific points along a value chain, capabilities are more broadly based, encompassing the entire value chain. Thus, organizational capabilities refer to the firm's ability to use its competences (Moingeon *et al.*, 1998).

Furthermore, the distinction between 'organizational capabilities' and 'core competencies' is not clear (Prahalad & Hamel, 1990). For example, Dosi *et al.* (2000) assume that the concept of 'core competencies' and 'dynamic capabilities' point in the same direction, being broadly concerned with the firm's ability to carry off the balancing act between continuity and change, and its capabilities. However, core competences are comparatively more durable than capabilities (Prahalad & Hamel, 1990). Organizational capabilities are based on knowledge, combine to become competences, and are referred to as core competencies when they represent a domain in which the organization excels (Prahalad & Hamel, 1990; Teece *et al.*, 1997).

A different concept that surfaced in the literature is the firm's 'core capabilities'. Leonard-Barton (1992) states that capabilities are considered *core* if they differentiate a firm strategically. Long & Vickers-Kroch (1995) also consider 'core capabilities' to be a combination between competences at specific points of the value chain and the strategic processes that link the chain together. In effect, this term is used to denote a firm's 'core competencies', as they can often be leveraged across different products and markets, and typically comprise or orchestrate other capabilities (Leonard-Barton, 1992; Miller, 2003).

Another concept that has been used interchangeably with organizational capabilities is the firm's 'combinative capabilities', that describes the organizational processes by which firms synthesize and acquire knowledge resources, and generate new applications from those resources (Kogut & Zander, 1992). The concept of 'combinative capabilities' is related to Schumpeter's argument that innovations are new combinations of

existing knowledge and incremental learning (Kogut & Zander, 1992). This concept is similar to 'dynamic capabilities' (Eisenhardt & Martin, 2000), as it emphasizes the firm's ability to handle change by transforming old capabilities into new ones (Dosi *et al.*, 2000).

Organizational capabilities can be classified as either 'operational' or 'dynamic' and include two sorts of routines: those to perform individual tasks and those that coordinate the individual tasks (Winter, 2000; Zollo & Winter, 2002; Helfat & Peteraf, 2003).

Operational capabilities

Zollo & Winter (1999, 2002) define operational capabilities as operating routines or organizational activities geared towards the operational functioning of the firm including both staff and line activities. In this definition the term routine refers to a 'repetitive pattern of activity' (Nelson & Winter, 1982). Winter (2003) considers operational or ordinary capabilities as 'zero-level' capabilities that are exercised in a stationary process or hypothetical 'equilibrium' where a firm continues earning rents by producing and selling the same product, at the same scale, and to the same customer population over time. Dynamic capabilities, however, differ from operational capabilities as they relate to the firm's ability to create and sustain competitive advantage through its ability to manage change (Teece, 2005). Dynamic capabilities, as operational capabilities, arise from learning and constitute the firm's systematic methods for modifying and shaping operational capabilities (Zollo & Winter, 2002). To the extent that the learning mechanisms are themselves systematic, they could also be regarded as 'second order' dynamic capabilities (Collis, 1994).

Dynamic capabilities

The concept of 'dynamic capabilities' has recently emerged in the strategic management literature (Teece *et al.*, 1997; Eisenhardt & Martin, 2000; Zollo & Winter, 2002; Zott, 2003). At least three different but complementary definitions can be found for a firm's dynamic capabilities. Teece *et al.*, (1997) define dynamic capabilities as 'the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments'. Similarly, Eisenhardt & Martin (2000) argue that dynamic capabilities are 'the firm's processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match and even create market change. Dynamic capabilities thus are the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve, and die'. Zollo & Winter (1999, 2002) focus mostly on the evolution aspect of a dynamic capability defining it as 'a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness'. When we split the concept of 'dynamic capabilities', the term 'dynamic' refers to the shifting

character of the environment. However, the term 'capabilities' emphasizes the key role of strategic management in appropriately adapting, integrating, and reconfiguring internal and external organizational and functional capabilities toward the changing environment (Teece & Pisano, 1994). Building dynamic capabilities relates especially to the environmental and technological sensing apparatus that the firm has established, the choice of organizational form, and the ability to strategize (Teece, 1998). According to Eisenhardt & Martin (2000), some dynamic capabilities integrate resources (e.g., product development routines, strategic decision making), others focus on reconfigurations of resources within firms (e.g., transfer processes including routines for replication and brokering), and others are concerned with gaining or releasing resources (e.g., alliance and acquisition routines). Similarly, Teece (2005) classifies dynamic capabilities into three categories: (1) difficult to replicate routinized processes; (2) dynamic capabilities through the selection and implementation of an improved business model; (3) the decision frames and heuristics which enable firms to avoid poor investment choices and embrace astute ones; and (4) dynamic capabilities encompassing *orchestration* skills achieved by *intrapreneurship*, entrepreneurship, and astute managerial decisions. These dynamic capabilities might affect the capacity to learn, the way knowledge flows, and consequently the firm's knowledge dynamics.

These classifications suggest that there is a 'hierarchy' of dynamic capabilities (Collis, 1994). Effective patterns of dynamic capabilities also vary with market dynamics (Eisenhardt & Martin, 2000). In moderately dynamic markets, dynamic capabilities resemble a traditional conception of routines, as they are complicated, detailed, analytic, and linear. However, in high-velocity markets, dynamic capabilities are simple, experiential, unstable, and iterative. Therefore, the dynamic capabilities approach is especially relevant in a Schumpeterian world of innovation-based competition, price-performance competitive advantage, rivalry, increasing returns, and the 'creative destruction' of existing competences (Teece *et al.*, 1997). Therefore, the coordinating and resource allocating capabilities featured in dynamic capabilities shape markets, as markets shape firms (Chandler, 1990; Teece, 2005). Put simply, dynamic capabilities enable the co-evolution of firms and markets (Williams, 1992).

Based on the above discussion we create the following propositions (Figure 3):

Proposition 4a: *An organizational capability is a high-level routine, or collection of socially complex routines, developed through learning mechanisms; it involves the transformation of inputs into outputs.*

Proposition 4b: *Organizational capabilities can be split into two types: operational capabilities and dynamic capabilities. Operational capabilities are concerned with the operational*

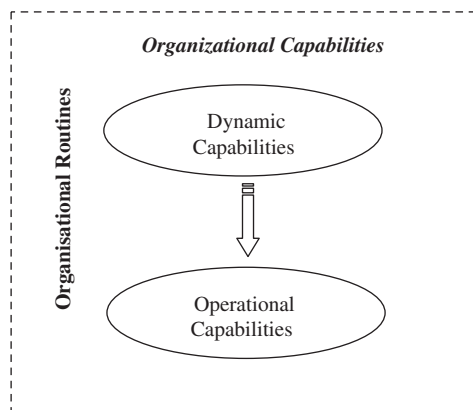


Figure 3 Organizational capabilities.

functioning of the firm. Dynamic capabilities, however, relate to the firm's ability to manage change and consequently, they modify, shape, and reshape operational capabilities.

Organizational capabilities and sustainable competitive advantage

In this part, we explore the concept of 'sustainable competitive advantage' from a market-based and a resource-based perspective, before analyzing how organizational capabilities, either operational or dynamic, deliver a long-lasting competitive advantage and consequently impact overall performance and firm success.

Sustainable competitive advantage

A firm's competitive advantage has been explained by both exogenous/market factors and a firm's internal resource endowments (Coyne, 1986; Cockburn *et al.*, 2000; Wiggins & Ruefli, 2002). McGrath *et al.* (1995) argue that there are two major paradigms for explaining a firm's superior performance. First, traditional industrial organization (IO) economics emphasize the barriers to competition, and takes the position that industry effects explain the greater part of persistent above-normal returns (Bain, 1956; Caves & Porter, 1977; Porter, 1985). For example, Bain (1956) in his 'structure-conduct-performance' hypothesis, argues that industry structure (e.g., number of sellers and buyers, product differentiation, barriers to entry, degree of fixed vs variable costs, vertical integration) determines firm conduct (e.g., pricing, advertising), which in turn determines economic performance (e.g., social allocative efficiency and firm profitability).

The second major paradigm, the resource-based view of the firm, assumes that firms accumulate unique combinations of resources that allow them to garner rents on the basis of their organizational capabilities (Barney, 1991; Grant, 1991; Peteraf, 1993). The central elements of the resource-based theory reside in the fact that it

considers firms as seekers of costly-to-copy inputs for production and distribution (Conner, 1991; Coff, 2003). However, these two perspectives, even though based on different theoretical grounds, are in fact seen as complementary in explaining a firm's competitive advantage (Peteraf & Bergen, 2003). According to Andrews (1971), the role of the strategist is to match the opportunities of the achievement with what the firm is capable of doing at an acceptable level of risk, while safeguarding its weaknesses from the threats of the same environment. Similarly, Wernerfelt (1984) states that 'entry barrier without a resource position (i.e., resources which can lead to high profiles) leaves the firm vulnerable to diversifying entrants, whereas a resource position barrier without an entry barrier leaves the firm unable to exploit the barrier'. Hence, a firm must create a situation where its own resource position directly or indirectly makes it more difficult for others to catch up (Wernerfelt, 1984). For instance, the concept of 'isolating mechanisms' introduced by Rumelt (1984) to denote 'phenomena that limit *ex post* equilibration of rents among individual firms', could be seen as an alternative to the Bain type IO's focus on entry barriers at the industry level (Conner, 1991). Therefore, a complete model of strategic advantage requires the full integration of models of the competitive environment, that is product market models, with models of firm resources, that is factor market models (Barney, 2001).

The term 'competitive advantage' was first used by Ansoff (1965) who has defined it as: '(to) isolate characteristics of unique opportunities within the field defined by the product-market scope and the growth vector. This is the competitive advantage. It seeks to identify particular properties of individual product markets which will give the firm a strong competitive position'. From this position the term 'sustainable competitive advantage' emerged when Porter (1985) discussed the basic types of competitive strategies firms can pursue, that is low-cost or differentiation, to achieve sustainable competitive advantage.

Peteraf (1993) argues that a firm's competitive advantage relates to its 'abnormal profitability', or the difference between its total profitability and its competitive or industry-wide profitability. Also, Peteraf & Barney (2003) assume that an organization has a competitive advantage if it is able to create more 'economic value' than the marginal competitor in its product market.

Conversely, a firm is said to have a 'sustained competitive advantage' when it is implementing a value creating strategy that is not simultaneously being implemented by any current or potential competitors and when these other firms are unable to duplicate the benefits of this strategy (Barney, 1991). A 'sustained' competitive advantage, does not, however, imply that it will 'last forever' (Barney, 1991). Hence, the sustainability of competitive advantage does not refer to a specified time period, but rather depends on the possibility and extent of competitive duplication. Similarly, the terms

'sustained competitive advantage' (Barney, 1991) and 'sustainable competitive advantage' (Grant, 1991) appear in the literature, but both can be interpreted in the same way. Generally, the term 'sustained' refers to 'long-term profitability' and 'above-average performance in the long run' (Porter, 1985; Schoemaker, 1990).

Hoopes *et al.* (2003) refer to a firm's sustainable competitive advantage by using the concept of 'competitive heterogeneity', which they define as 'enduring and systematic performance differences among relatively close rivals'. Inter-firm heterogeneity is generated through uncertain imitability (Lippman & Rumelt, 1982). Uncertain imitability is obtained by the creation of new production functions that are either causally ambiguous, or when property rights in unique resources impede imitation and factor mobility and can lead consequently to *supra*-normal industry profits together with a lack of entry (Lippman & Rumelt, 1982). Generally uncertain imitability can be linked to the attributes of the resource accumulation process (Dierickx & Cool, 1989). These attributes refer to what Rumelt (1984) coined as 'isolating mechanisms' and include *asset mass efficiencies* (i.e., the initial level of an asset stock significantly influences the pace of its further accumulation), *time compression diseconomies* (i.e., decreasing returns to the fixed factor time), *interconnectedness* (i.e., the pace of an asset accumulation is influenced by the level of other asset stocks), *asset erosion* (i.e., decay of stock assets in the absence of adequate maintenance expenditures), and *causal ambiguity* about the accumulation process (Dierickx & Cool, 1989).

Mainly two different but complementary frameworks could be identified in the resource-based view of the firm to explain the sustainability of competitive advantage. First, Barney (1991) advances that to have the potential of sustained competitive advantage, a firm's resource endowments must be: (1) *valuable* in the sense that they exploit opportunities and/or neutralize threats in the firm's environment; (2) *rare* among a firm's current potential competition; (3) *imperfectly imitable* because they are path dependent, causally ambiguous, and socially complex (Dierickx & Cool, 1989); and (4) *non-substitutable* by other valuable, rare, or imperfectly imitable resources. In this framework, even if a resource is valuable, rare, and difficult to imitate, if it has strategically equivalent substitutes that are themselves not rare, or not costly to imitate, then it cannot be a source of sustained competitive advantage. In effect, the substitutability conditions do not represent only the sustainability of competitive advantage, but also the *attainment* of competitive advantage by rivals as well (Peteraf & Bergen, 2003).

The second framework was proposed by Peteraf (1993), who defines four conditions that a firm's resources must meet to provide a sustainable competitive advantage. The first of these conditions is resource *heterogeneity*, from which a firm can generate Ricardian or Monopoly rents. *Ex post limits to competition* are necessary to sustain the

rents including what Rumelt (1984) referred to as 'isolating mechanisms'. *Imperfect resource mobility* ensures that the rents are bound to the firm and shared by it. Finally, *ex ante limits to competition* prevent costs from offsetting the rents.

This brings us to define a firm's sustainable competitive advantage as follows:

Proposition 5a: *A firm's competitive advantage is explained by matching industry and market effects, that is barriers to competition, with path dependent, causally ambiguous, and socially complex internal resource endowments, that consequently lead to supra-normal profitability.*

Proposition 5b: *Sustainable competitive advantage is expressed in terms of long-term abnormal profitability and above-average performance in the long run.*

Organizational capabilities and sustainable competitive advantage

As organizational capabilities are built internally through complex social and learning mechanisms, and formed by socio-technical processes or organizational routines, they are path dependent, causally ambiguous, and socially complex (Dierickx & Cool, 1989; Reed & DeFillippi, 1990). These characteristics make organizational capabilities heterogeneous and immobile between firms, and consequently they are difficult to trade or imitate, scarce, valuable, and non-substitutable (Lippman & Rumelt, 1982; Reed & DeFillippi, 1990; Barney, 1991). Subsequently, organizational capabilities become the source to generate economic value and higher performance in the long term (King & Zeithaml, 2001), and thereby represent the basis of a firm's sustainable competitive advantage (Amit & Schoemaker, 1993; Collis & Montgomery, 1995).

For instance, Penrose (1959) argues that the intertwining of resources and capabilities form the basis for sustainable competitive advantage: 'diversification and expansion based primarily on a high degree of competence and technical knowledge in specialized areas of manufacturing are characteristics of many of the largest firms in the economy. This type of competence together with the market position it ensures is the strongest and most enduring position a firm can develop'. By focusing on a firm's dynamic capabilities Teece *et al.* (1997) state that the firm's total panoply of dynamic capabilities are the major source of its competitive advantage as they are usually the source of Schumpeterian rents (Teece & Pisano, 1994).

Many empirical studies show the positive cause-effect relationship between organizational capabilities and superior performance. For example, Collis (1991) shows how firms' core competencies and implementation capabilities determine product market position and global competition in the bearings industry. Further Henderson and Cockburn (1994) find that the research

productivity in different pharmaceutical firms depends mostly on differences in research strategy, in firm and programme-specific resources, and in organizational capabilities, and that the 'right' bundle allows firms to explore product development strategies that are not available to their competitors.

Longevity of competitive advantage also depends upon the inimitability of the capabilities which underlie that advantage (Grant, 1996a,b). In fact, the broader the scope of knowledge integrated within a capability, and the more sophisticated the integration mechanisms, the greater the causal ambiguity and the barriers to imitate these capabilities (Grant, 1997; Marsh & Stock, 2003).

Organizational capabilities become the source of competitive advantage (Chandler, 1990) when they are leveraged into products and services that generate value and competitive advantage (Rouse & Daellenbach, 2002). The firm's enhanced performance might impact its learning and knowledge flows (e.g., investment decisions), which in turn *regenerate* new knowledge dynamics. However, the organizational routines that form a firm's organizational capabilities can sometimes create inertia which limits its ability to comprehend new signals from the environment and act upon them expediently (Helleloid & Simonin, 1994). Consequently, organizational capabilities become 'core rigidities' and therefore, hinder innovation and sustainable competitive advantage (Leonard-Barton, 1992).

Similarly, some scholars contrast the idea that organizational capabilities have the potential to generate sustainable competitive advantage, but only under certain circumstances (Hoopes *et al.*, 2003). For example, D'Aveni (1995) argues that in a hypercompetitive environment, developing flexible capabilities can only be applied across many actions to build a series of temporary advantages. In addition Geroski & Mazzucato (2002) advance that the performance differences among firms generated through their organizational capabilities is not constant over time, but varies unpredictably. In the

same way, Eisenhardt & Martin (2000) assume that even if dynamic capabilities are idiosyncratic in their details, they exhibit common features that are associated with effective processes across firms, and then they are not *per se* the source of sustainable competitive advantage. However, long-term competitive advantage lies in using dynamic capabilities sooner, more astutely, or more fortuitously than the competition.

From this discussion the following proposition is formulated (Figure 4):

Proposition 6: *As they are socially constructed, organizational capabilities, either dynamic or operational, are valuable, rare, inimitable, and non-substitutable. These characteristics make organizational capabilities immune to competitive duplication, and make them the sources of sustainable competitive advantage, and when they are leveraged into products and services they generate value and long-term superior performance.*

Conclusion

Starting from a characterization of knowledge assets as the intangible resources that a firm owns mainly in the form of employees' skills and know-how, and intellectual property rights, we argue that they support the firm's capabilities, activities, and products. Knowledge assets are dynamic in nature; they interact and depend on each other. Organizational learning mechanisms enable this interconnectivity between knowledge assets, and constantly renew and enhance their value. Furthermore knowledge management processes such as knowledge identification, sharing, storing and application, support organizational learning by generating new knowledge and facilitating its effective and efficient management.

We refer to these interactions and interdependencies between knowledge assets, learning mechanisms and knowledge management processes as *knowledge dynamics*,

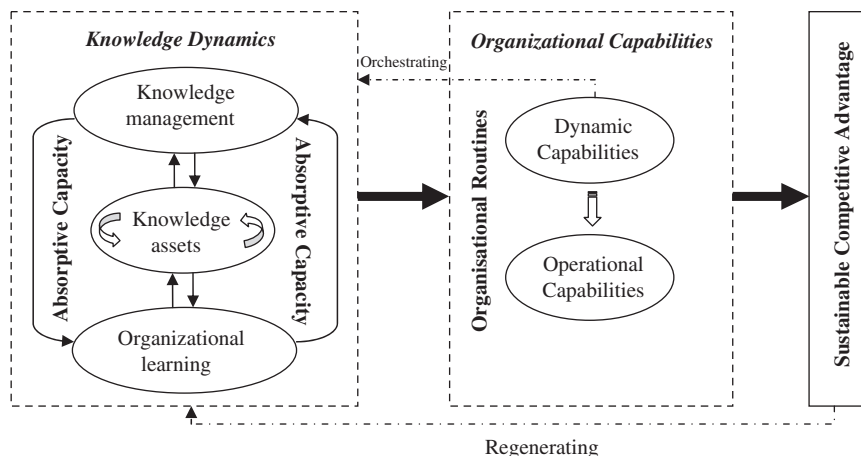


Figure 4 Knowledge dynamics, organizational capabilities, and sustainable competitive advantage.

through which a firm's knowledge assets are bundled, linked, incorporated, converted, organized, and integrated into socio-technical processes or organizational routines. Subsequently, these organizational routines are enriched, nurtured, and leveraged to form the firm's organizational capabilities. We argue that this integration process is facilitated by the firm's absorptive capacity, which includes its ability to assimilate external knowledge derived from its competitive environment, analyze the stocks and flows of knowledge, and influence the generation of new knowledge that is necessary to shape and build its capabilities.

We propose a definition of organizational capabilities as higher-level routines or a collection of socially complex routines that involve the transformation of inputs into outputs. Organizational capabilities are either dynamic or operational. Operational capabilities involve the firm's production activities and ordinary operations. However, dynamic capabilities are more concerned with change and they constantly facilitate the shaping of firm's operational capabilities.

After, we discuss the concept of 'sustainable competitive advantage' from an industry and market perspective and a resource-based view, and we suggest that a firm's competitive advantage is explained both by competitive factors, as well as by path dependent, causally ambiguous and socially complex attributes. We proposed that a firm's sustainable competitive advantage is manifested in long-term abnormal profitability and above-average performance.

Finally, we argue that as organizational capabilities, either operational or dynamic, are socially constructed, they are valuable, rare, inimitable, and non-substitutable. In fact, these characteristics make them heterogeneous and immobile, and therefore a potential source of long-term *supra*-normal profitability and superior performance.

Research contributions to theory

Our theoretical model is *Schumpeterian* in its emphasis on the restless dynamics of knowledge resources. It is also *Penrosian* in its view of firm capabilities being built from a resources base, and put to use in generating value

through organizational routines. We believe that by introducing a model that demonstrates the link between knowledge dynamics, the development of organizational capabilities, and sustainability of a firm's competitive advantage, the paper provides a significant clarification of how a firm's knowledge assets drive long-term profitability and performance. Hence, we provide a step further towards understanding the concept of knowledge assets as a driver of performance.

In addition, this paper is consistent with the knowledge-based view by emphasizing the dynamic nature of knowledge inside the firm, and contributes to the resource-based view through a conceptualization of some ideas which have recently emerged in the strategic management literature, offering convergence of ideas and improved definitions of the concepts discussed as well as any relationships between them. It therefore provides another step towards a 'common language and understanding'.

Further research agenda

We believe that the research presented in this paper lays a foundation for further theoretical and empirical inquiry into the nature of firm's knowledge assets, organizational capabilities, and the sources of sustainable competitive advantage. Beyond the fact that the research furthers our theoretical understanding, we hope that it provides useful avenues for further empirical inquiry as well as in-depth case studies to find practical evidence of the propositions underpinning the theoretical model outlined in this paper.

In fact, even with an initial theoretical model, we still know little about the specifics of how knowledge assets drive sustainable competitive advantage and firm performance.

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About the author

Karim Moustaghfir is an assistant professor and program coordinator of Human Resource Development at Al Akhawayn University in Ifrane, Morocco. He is also the general coordinator of the Mediterranean School of Advanced Studies in e-Business Management (Italian-Moroccan Partnership). During his Ph.D. he was also a visiting fellow

at the Centre for Business Performance – Cranfield School of Management. After completing his Master and Ph.D. degrees, he worked as Post-doctoral Researcher at Scuola Superiore ISUFI – Università del Salento, Italy. He now researches on the topic of dynamic capabilities, knowledge assets, and their impact on firm performance.

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