LEVERAGING KNOWLEDGE ASSETS
IN FIRMS OF THE DIGITAL ERA

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Abstract

The management of organisational knowledge can be a key lever for improving performance, boosting productivity and creativity and facilitating innovation in corporate settings. The commonly used approaches for managing knowledge followed one of two perspectives: the process-centric (a primarily people-based approach that treats knowledge management as a social communication process) and a product-centric approach (that is mostly content-based and focuses on knowledge-related artefacts). This chapter presents a strategic management approach and an integrated solution that are knowledge asset-based and attempt to fuse the aforementioned two approaches in a balanced manner. The overall approach builds upon and extends the resource-based view of the firm by explicitly treating knowledge assets as the main driver for innovation and learning. The approach is demonstrated with a case study that focuses on the knowledge networks of a software firm.

Keywords

Knowledge Management; Strategic Management; Resource-based View; Learning; Innovation.
1. Introduction

Organizations of all kinds are coming to the realization that knowledge is their greatest competitive asset. And as knowledge becomes the key strategic resource of the future, the need of organizations to develop a comprehensive understanding of knowledge strategies, processes and tools for the creation, transfer and deployment of this unique asset is becoming critical.

The task of developing and applying “Knowledge Management” (KM) as a new discipline is a challenging endeavour. This new discipline must successfully respond to the diverse needs of companies in a timely fashion. For businesses that must compete in a daily changing world, superior management of knowledge is the key to innovation, productivity, and growth.

This chapter presents a strategic management framework to Knowledge Management (KM) that is based on managing an organization's knowledge assets in order to create value. Moreover, it presents a holistic knowledge management solution that was developed within two applied research and technology development projects and was validated in eight companies that are considered to be typical examples of firms of the digital era; the eight firms belong to the financial services sector, the IT sector and the professional services sector; see also Mentzas et al (2002) and Apostolou and Mentzas (2002).

The motivation to develop the solution presented herein was the realisation that practical KM efforts in organizations adopt one of two approaches: the process-centric approach, that mainly treats KM as a social communication process; and the product-centric approach, that focuses on knowledge artefacts, their creation, storage and reuse in computer-based corporate memories. We found evidence of this distinction not only in KM implementations in companies, but also in supporting methodologies and tools; see e.g. Mentzas et al (2000 and 2002).

However it is our belief that in order for organisations of the 21st century to add value to their product and service offerings a perspective is required that would fuse these two approaches. The aim of this chapter is to present a solution that provides a balanced fusion of these two KM views.

The chapter is structured in the following way. The next section gives a brief overview of the process and product approaches in Knowledge Management and the implications of adopting them within organisational settings; it also outlines the need for their balanced fusion in practical KM applications. Section 3 discusses two of the main current approaches to strategic management, i.e. the competitive approach to strategy and the resource-based perspective of the firm and proceeds with their shortcomings in the knowledge economy. Section 4 outlines the conceptual foundation of our framework, i.e. its focus on knowledge assets and knowledge objects, while section 5 briefly describes the overall solution proposed.
Section 6 examines knowledge networking and presents a case study of our solution in a software firm. Finally the last section discusses some concluding remarks and the implications of knowledge asset management.

2. Process and Product Approaches in Knowledge Management

2.1. Knowledge and Knowledge Management

The task of developing and applying “Knowledge Management” (KM) as a new discipline is a challenging endeavour. This new discipline must successfully respond to the diverse needs of companies in a timely fashion. However, despite a wealth of books, reports and studies, neither researchers nor practitioners have an agreed definition of “Knowledge Management”. The term is used loosely to refer to a broad collection of organisational practices and approaches related to generating, capturing and sharing knowledge that is relevant to the organisation’s business. There are many interpretations as to what it exactly means and how to best address the emerging questions about how to effectively use its potential power; see e.g. Nonaka & Takeuchi (1995), Davenport & Prusak (1998), Edvinsson & Malone (1997) and Wiig (1995). Some would even argue that “Knowledge Management” is a contradiction in terms, being a hangover from an industrial era when control modes of thinking were dominant.

Whatever the term and the definition employed to describe it, knowledge management is increasingly seen, not merely as the latest management fashion, but as signalling the development of a more organic and holistic way of understanding and exploiting the role of organisational knowledge in the processes of managing and doing work.

A definition that is suitable for our purposes is the one given by Davenport and Prusak (1998), who define knowledge as "a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices, and norms". This definition highlights two important types of knowledge - explicit knowledge and tacit knowledge; see also Nonaka and Takeuchi (1995).

Tacit knowledge refers to that knowledge which is embedded in individual experience such as perspective and inferential knowledge. Tacit knowledge includes insights, hunches, intuitions, and skills that are highly personal and hard to formalise, making them difficult to communicate or share with others. Tacit knowledge is also deeply rooted in an individual’s commitment to a specific context as a craft or profession, a particular technology or product market, or the activities of a work-group or team. With other words tacit knowledge is deeply ingrained into the context, i.e. the owner’s view and imagination of the world and into his/her experience, which is previously acquired knowledge.

Explicit knowledge is knowledge that has been articulated in formal language and which can be easily transmitted among individuals. It can be expressed in scientific formulae, codified procedures or a variety of other forms. It consists of three components: a language, information and a carrier. The language is used to express and code knowledge. Information is coded externalised knowledge. It is potential knowledge, which is realised when
information is combined with context and experience of humans to form new tacit knowledge. The carrier is capable to incorporate coded knowledge and to store, preserve and transport knowledge through space and time independent of its human creators.

Both explicit knowledge and tacit knowledge are important for the organisation. Both must be recognised as providing value to the organisation. It is through the conversion of tacit to explicit knowledge and explicit to tacit knowledge in the organisation that creativity and innovation are released and the potential for value creation arises. The goal, then, is to leverage both explicit knowledge and tacit knowledge and to reduce the size of the organisational knowledge gaps.

The business and popular press abound with real-world industrial examples of initiatives that attempt to address these goals. Such initiatives may be classified within three strands. First, some companies, like Dow Chemical, address innovation in product development initiatives, either by making sure that knowledge is embedded in their products, or by identifying and reusing knowledge. Second, organisations like Texas and Chevron develop process and operational improvement initiatives that focus on the transfer of best practices by creating best practice databases and organising best practice sharing events. Third many companies (e.g. in the telecommunications and the banking sectors) develop customer and market initiatives, in which they mine customer data to make sense of who buys and why, and how to keep clients buying.

2.2. The Process and Product Approaches in KM

Knowledge management (KM) has moved from an early premature phase – characterised by considerable hype and confusion – to a state of relative maturity, in which the value it brings to business and government organisations is not disputed. The adopters of this new discipline have followed different approaches with varying emphasis on technology, cultural, organisational and managerial issues. Nevertheless, if one looks into the research landscape as well as into the business applications of KM, it is easy to notice that two main perspectives for knowledge management are usually employed; see e.g. Hansen et al (1999), Koehn and Abecker (1997) and Spek and Spijkevert (1997). Let’s call them the “product” and the “process” approaches.

The “product” approach implies that knowledge is a thing that can be located and manipulated as an independent object. Proponents of this approach claim that it is possible to capture, distribute, measure and manage knowledge. This approach mainly focuses on products and artefacts containing and representing knowledge; usually, this means managing documents, their creation, storage, and reuse in computer-based corporate memories. Examples include: best-practice databases and lessons-learned archives, case-bases which preserve older business-case experiences, knowledge taxonomies and formal knowledge structures, etc. This approach is also referred to as ‘content-centred’ or ‘codification’ approach.

Adopting a “product-centric” approach to KM means treating knowledge as an entity rather separate from the people who create and use it. The typical goal is to take documents with explicit knowledge embedded in them — memos, reports, presentations, articles, etc. — and store them in a repository where they can be easily retrieved. Examples of companies that aim at a continual enhancement of their knowledge base — the collection of best practices, methods and reusable work products — include General Motors, Glaxo Wellcome and DaimlerChrysler.
The “process” approach puts emphasis on ways to promote, motivate, encourage, nurture or
guide the process of knowing, and abolishes the idea of trying to capture and distribute
knowledge. This view mainly understands KM as a social communication process, which can
be improved by collaboration and cooperation support tools. In this approach, knowledge is
closely tied to the person who developed it and is shared mainly through person-to-person
contacts. The main purpose of Information and Communication Technology (ICT) in this
case is to help people communicate knowledge, not store it. ICT tools in this case comprise
e.g., e-mail, video-conferencing, workflow management systems, systems for the distributed
authoring of hypertext documents, group-decision support systems, etc. This approach has
also been referred to as the ‘collaboration’ or ‘personalisation’ approach.

Firms adopting a “process-centric” approach in their KM initiatives, focus on the creation of
communities of interest or practice (self-organised groups which ‘naturally’ communicate
with one another because they share common work practices, interests, or aims), to address
knowledge generation and sharing. The emphasis in this case is on providing access to
knowledge or facilitating its transfer among individuals. For example, companies like British
Petroleum, Skandia, Buckman Laboratories and Matsushita strive to create corporate
environments that nurture knowledge communities, in order to facilitate the exchange of
ideas and collaboration across the organization.

The existence of these two approaches in knowledge management can be attributed no less to
its different origins. Artificial intelligence and knowledge engineering for instance have
historically focused on technologies for codification and organization, in contrast to
organizational theory that has always treated knowledge independently for the people that
own it.

Table 1 summarises the basic characteristics of the two approaches in terms of their strategic,
technological, and human resource-related directions; see also Hansen et al (1999) for an
analysis.
<table>
<thead>
<tr>
<th>Focus</th>
<th>Product-centric approach</th>
<th>Process-centric approach</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Knowledge is represented as objects. The emphasis is on capturing, organizing and sharing knowledge objects. Utilization of products and systems that contain codified knowledge.</td>
<td>Knowledge is associated with the individual that owns it. Knowledge sharing is accomplished through human contacts and relations.</td>
</tr>
<tr>
<td>Strategy</td>
<td>Exploitation of organized, codified and easily re-usable knowledge. Linking of people with systems that capture and disseminate knowledge.</td>
<td>Exploitation and empowerment of individual and team knowledge. Development of networks for linking people, promotion and facilitation of discussions so that tacit knowledge can be shared.</td>
</tr>
<tr>
<td>Human Resources</td>
<td>Employment of professionals who are well suited to the reuse of knowledge. Training is facilitated passively (through courses, presentations, computer-based courses). Rewarding focuses on using and contributing to the organizations knowledge base.</td>
<td>Employment of highly creative professionals that work in teams. Training is facilitated through on-the-job learning, group brainstorming sessions, and one-to-one mentoring. Rewarding focuses on group performance and knowledge sharing between professionals.</td>
</tr>
<tr>
<td>Information Technology</td>
<td>Heavy investment in IT. Tools include document repositories, search and retrieval tools.</td>
<td>Moderate investment in IT. Tools include discussions databases, real-time communication and collaboration tools, net conferencing and push technologies.</td>
</tr>
</tbody>
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Table 1. Characteristics of the Process- and Product-centric KM Approaches

2.3. The Need to Integrate the Two Approaches

The question that arises is: which companies and when, should adopt one or the other approach? The choice of the overall approach to be followed by a KM initiative should not be arbitrary, neither should it be ad hoc; it depends on the company characteristics, they ways the company delivers its products and services, its financial characteristics and its organisational culture.

One solution proposed in the literature is to relate the choice of the most appropriate approach to the vital characteristics of a company’s product or service; see Hansen et al (1999) and Table 2.

The product-centric approach is more likely to be followed by companies whose business strategy is based on standardised and mature products. The processes for developing and selling such products involve well-understood and well-organised tasks and the product knowledge is relatively rigid – thus more easily codified. In such cases, developing a strategy around the “knowledge as a product” approach seems more suitable.
The process-centric approach on the other hand is more likely to be followed by companies whose value proposition is based on developing highly customised and/or extremely innovative products or services that meet unique customer needs. Because these needs vary dramatically, codified knowledge is of limited value. In those cases, adopting a “knowledge as a process” approach that mainly supports the sharing of knowledge, expertise and judgment, seems more appropriate.

<table>
<thead>
<tr>
<th>Knowledge as a “Product”</th>
<th>Standardisation of product or service</th>
<th>Maturity of product or service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge as a “Process”</td>
<td>Customised</td>
<td>Innovative</td>
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Table 2. Relation of KM approach to product characteristics

Such a roadmap may be useful for some extreme cases, but seems to be of limited value in supporting the decisions of companies that operate within the constantly challenging e-business world in which there is a clear need towards delivering product-service hybrids with distinct characteristics: their life time is linked to the life of the customer need; their major cost element is the cost of design; their main revenue model is subscription and user-fees; and their marketing objective is building communities of satisfied clients.

Hence the challenge faced by firms in the digital era is to effectively exploit the intangibles that add value to these “offerings”: technical know-how, design of the offering, marketing and presentation, understanding of the customer need, etc., so that they can ‘integrate’ knowledge in their offerings and create new value by designing and developing new offerings.

These challenges call for the integration of the “knowledge as a process” approach (which will facilitate the leveraging of tacit, intangible knowledge) with the “knowledge as a product” approach (which will enable the consistent management of explicit knowledge, like e.g. best practices). So there is a real need for a balanced fusion of the two KM views. Such a fusion should clearly focus on the knowledge assets of the company, link strategic and operational issues in a consistent manner, and enable leveraging the key knowledge of the firm at various levels, i.e. at the individual, team and organisational levels.

The next section outlines the conceptual framework of our approach, which aims at explicitly providing for such a fusion.

3. A Strategic Perspective to Knowledge Assets

The methodological of the knowledge-asset centric framework should ensure the fusion of the product-centric KM approach with the process-centric KM approach. What is needed is a conceptual, theoretical foundation that will guarantee this fusion and that would be underlying every aspect of the solution (software tool, consulting methodology, measurement system, etc.).

Both the process and the product-based approaches aim to support the identification, managing and leveraging of knowledge, through better managing of the organisation’s knowledge assets. Knowledge assets are the resources that organisations wish to cultivate. In
essence, knowledge management aims to better manage the content, quality, value and transferability of knowledge assets.

The focus of our framework is on knowledge assets as the critical strategic resources of the firm. Such a focus is in line with the recent trend in the strategic management literature to leverage the internal resources of the firm in order to create value. The following paragraphs briefly outline two commonly used approaches to strategic management: the competitive strategy approach and the resource-based view, and proceeds with analysing our knowledge asset-centric approach as the proposed theoretical solution to integrating the product- and process-centric approaches.

3.1. The Competitive Approach to Strategy

The competitive strategy perspective posits that competitive advantage is derived from the firm’s environment, more precisely from the industry in which it competes. In fact, the goal of competitive strategy for a company or business unit is to “...find a position in the industry where the company can best defend itself against... competitive forces (entry, threats of substitution, bargaining power of buyers, bargaining power of suppliers, and rivalry among existing competitors) or can influence them in its favour”; see Porter (1980).

The competitive strategy perspective can be seen as an “outside-in” approach to understanding the basis of competitive advantage. This approach stresses that an effective competitive strategy calls for the firm to take offensive or defensive action to create a defendable position against competitive forces. Thus, industry conditions determine the rules of the game when it comes to the nature of competition and the strategies available to firms.

A major assumption of this perspective is that all relevant, industry-specific resources are distributed homogeneously and are perfectly mobile. That is, the basis for competition is not derived from the firm as such, but rather from the characteristics of the industry. Consequently, superior performance in an industry or strategic group results from this environmentally-derived competitive advantage.

A second assumption of this approach is that both demand and supply conditions are known, and, consequently, market conditions are relatively stable. In a stable demand environment, competition is viewed as a zero-sum market share rivalry between existing and potential firms. Also, because the demand side of the market is known or predictable, competitive advantage stems from the supply side.

Consequently, selecting the competitive advantage that yields the highest levels of economic performance requires intensive analysis of the industry structure, of suppliers, buyers, new entrants, and threats from substitutes, as discussed in depth by Porter (1980) and other authors within the industrial organization paradigm.

Thus, the essence of formulating a competitive strategy is to relate a company to its environment, analogous to the opportunities and threats part of the classical SWOT-analysis. The essence of this approach was expressed by Porter (1980) as: “Worship the environment – not the inside [of the firm]”.

The two assumptions mentioned above (i.e. homogeneous distribution of resources and already known demand and supply conditions) have been raised in the resource-based view.
3.2. The Resource-Based View to Strategy

From the resource-based perspective the firm is seen as a portfolio of resources. What a firm can do to create competitive advantage is not simply a function of the opportunities in the environment (industry) but also of what resources the firm can assemble; see e.g. Wernerfelt (1984). The resource-based perspective is an “inside-out” approach to understanding the basis of competitive advantage.

The resource-based view (RBV) of the firm focuses attention on how firms achieve and sustain advantages and contends that the answer to this question lies in the possession of certain key resources. Sustained competitive advantage can be obtained if the firm effectively deploys these resources in its product-markets. The list of resources in any given firm is likely to be a long one.

One of the principal insights of the resource-based view is that not all resources are of equal importance or possess the potential to be a source of sustainable competitive advantage. Much attention has focused, therefore, on the characteristics of advantage-creating resources and various approaches have been followed in analysing the characteristics of advantage-creating resources. For example, Barney (1991) proposes that advantage-creating resources must meet four conditions, namely, value, rareness, inimitability and non-substitutability, while Grant (1991) argues that the levels of durability, transparency, transferability and replicability are important determinants.

Strategic, advantage-generating resources comprise three distinct sub-groups, namely tangible assets, intangible assets and capabilities.

Tangible assets refer to the fixed and current assets of an organization, which have a fixed long-run capacity. Examples include plant, equipment, land, other capital goods and stocks, debtors and bank deposits. Tangible assets have the properties of ownership, their value is relatively easy to measure and they are relatively weak at resisting duplication efforts by competitors.

Intangible assets include intellectual property such as trademarks and patents as well as brand and company reputation, company networks and databases. The presence of intangible assets accounts for the significant differences between the balance sheet valuation and stock market valuation of publicly quoted companies. Intangible assets have relatively unlimited capacity and firms can exploit their value by using them in-house, renting them (e.g. a licence) or selling them (e.g. selling a brand). They are relatively resistant to duplication efforts by competitors.

Capabilities have proved more difficult to delineate. Capabilities encompass the skills of individuals or groups as well as the organisational routines and interactions through which all the firm's resources are co-ordinated (Grant, 1991). Typical of the latter, for example, are teamwork, organizational culture and trust between management and workers. Capabilities have limited capacity in the short run due to learning and change difficulties but have relatively unlimited capacity in the long run.

Although the resource-based view recognizes the importance and role of knowledge in firms achieving a competitive advantage, we argue that the RBV does not go far enough. Specifically, the RBV treats knowledge as a generic resource, rather than having special
properties, and subsequently, does not make any distinction between different types of knowledge-based capabilities.

3.3. Characteristics of Knowledge Assets

Knowledge assets are different from other firm resources; see e.g. Glazer (1991) and Day and Wendler (1998).

Knowledge assets are not easily divisible or appropriable. This means that the same information and knowledge can be used by different economic entities at the same time. Moreover, knowledge assets are not inherently scarce (although they are often time-sensitive). This implies that they are not depletable.

Knowledge assets are essentially regenerative. This means that new relevant knowledge may emerge from a knowledge-intensive business process as additional output besides products and services.

Knowledge assets may not exhibit decreasing returns to use, but will often increase in value the more they are used. This characteristic is of crucial importance for senior management; see e.g. den Hartigh nd Langerak (2001). Most assets are subject to diminishing returns, but not knowledge. The bulk of the fixed cost in knowledge products usually lies in creation rather than in manufacturing or distribution. Once knowledge has been created, the initial development cost can be spread across rising volumes. Network effects can emerge as knowledge assets are used by more and more people. These knowledge-users can simultaneously benefit from knowledge and increase its value as they add to, adapt, and enrich the knowledge base. In traditional industrial economics, assets decline in value as more people use them. By contrast, knowledge assets can grow in value, as they become a standard on which others can build.

As knowledge assets grow, they tend to branch and fragment. Today’s specialist skill becomes tomorrow’s ticket to play, as fields of knowledge grow deeper and more complex; or as Drucker (1997) puts it “knowledge constantly makes itself obsolete, with the result that today’s knowledge is tomorrow’s ignorance”. While knowledge assets that become standards can grow more and more valuable, others, like expiring patents or former trade secrets, can become less valuable as they are widely shared. A successful company must therefore continually refresh its knowledge base. The rapid and effective re-creation of knowledge can represent a substantial source of competitive advantage.

4. Conceptual Foundation of the Approach

The focus of this paper is not on what knowledge is; rather it is on what knowledge can do. Hence for the purpose of having a definition of knowledge we extend a definition given by Nonaka (1991) according to which “knowledge is justified belief that increases an entity’s capacity for effective action”.

Our definition of knowledge is: The ideas, or understandings, which an entity possesses that are used to take effective action to achieve the entity's goal(s). Our focal point is the business domain and we examine individuals, teams, organisations and inter-organisational settings (e.g. virtual enterprises) as entity types that leverage knowledge to create business goals and achieve commercial values.
We consider knowledge management to be “a new discipline of enabling individuals, teams and entire organisations to collectively and systematically create, share and apply corporate knowledge assets to better achieve organisational efficiency, responsiveness, competency and innovation”.

Knowledge management encompasses the identification and mapping of knowledge assets within the organisation, the generation of new knowledge assets for competitive advantage, making knowledge assets accessible and sharing them across an organisation.

Our framework tackles the fact that knowledge management should be implemented as an on-going business task with two primary aspects:

- treating the knowledge component of business performance, reflected in strategy, processes, structure and systems at all levels of the organisation.

- making a direct connection between the organisational knowledge assets - both explicit and tacit - and improved business performance.

From a conceptual abstract point of view, for the integration of the process and product views we follow the work of Cook and Brown (1999) who strive to explain how knowledge is connected to the actions of individuals and groups. Their concept of knowing, i.e. putting knowledge into practice, is close to our concept of knowledge as a process. Cook and Brown (1999) call “what is ‘possessed’ knowledge and what is part of action ‘knowing’” (p.383).

In other words knowing is putting knowledge in practice while knowledge is knowing at rest. They admit that “this does not mean that knowledge of abstract concepts and principles is useless to action, only that it is not the same as enacting the skills associated with it” (p.19). Cook and Brown (1999) also add that knowledge itself does not underlie or enable knowing, just as having a hammer may not mean one knows how to use it.

In this way we may introduce a static (“knowledge as a product”) mode, and a dynamic (“knowledge as a process”) mode in knowledge management. Knowledge represents the static mode as what we possess we do not always use, and knowing is the dynamic mode as it is representing a concrete, dynamic human action and it focuses on the interactions with the social and physical world.

We are interested both in managing the "stock" of knowledge (that covers the "knowledge as an object" approach) and the "flow" of knowledge (that addresses the "knowledge as a process" approach) within the organisation; see Figure 1.
Our perspective is that ‘knowledge assets’ can be human – such as a person or a network of people, structural – such as a business process, or market – such as a brand name of a product. Naturally the product-centric approach is more concerned with accessing and organising knowledge assets while the process approach makes direct connections between the organisational knowledge assets - both explicit and tacit. Both approaches however are using some form of knowledge representation as a means of packaging and transferring knowledge either from a person to a system and vice versa or between people.

If we define as ‘knowledge objects’ the means of representing knowledge then the following statement outlines the relation between knowledge assets and knowledge objects: *A knowledge asset creates, stores and / or disseminates knowledge objects.*

For example: a person is a knowledge asset that can create new ideas, learnings, proposals, white papers (knowledge objects); a community of interest is a knowledge asset that can create new ideas, best practices (knowledge objects); a process is a knowledge asset that can create and/or store and disseminate best practices, company standards, R&D material (knowledge objects); a vision is a knowledge asset that can create a new mission statement, strategic plan, goals (knowledge objects).

A Knowledge Object represent the information required to be processed by humans and transformed in to knowledge; see Figure 2. Knowledge derives from information through knowledge-creating activities that take place within and between humans. Typical knowledge-creating activities include; see e.g. Davenport and Prusak (1998):

- Comparison: how does information about this situation compares to other situations known?
- Consequences: what implications does the information have for decision and actions?
- Connections: how does this bit of knowledge relate to others?
- Conversation: what do other people think about this information?
The Knowledge Objects aim to facilitate and leverage such knowledge-creating activities by providing to human the information need. A Knowledge Object has the following characteristics:

- It acts as a catalyst, enabling the fusion of knowledge flows between people, with knowledge content discovery and retrieval, through technology. That is to say, a knowledge object acts, amongst other things, as the primary connecting node for all key components in a KM system (strategy, people, process, content, technology) - 'the KM glue'.

- It facilitates the knowledge transfer from person to person, or from information to person.

- A Knowledge Object is created and maintained by a KM process.

- A Knowledge Object is used to search, organise and disseminate knowledge content.

We conclude that the Knowledge Assets and Knowledge Objects are the common unifiers of the knowledge-asset framework that incorporates and integrates process and content. We have used these concepts as the 'resultant manifestation' in the design of a KM solution that fuses the process-centric approach with the product-centric approach that is further examined in the next section.

5. The Knowledge Asset Management Solution

The practical application of the theoretical approach described so far was implemented within the Know-Net knowledge management solution that comprises three components:
1. An holistic conceptual framework that can be used by managers as a roadmap for ensuring integrity of the Knowledge Management effort.

2. A KM methodology that helps organisations define and document their knowledge management strategy, audit and design business processes that enhance and facilitate corporate learning, establish related organisational roles, facilitate knowledge sharing between people in the organisation, and explicitly measure and evaluate the quality and business value of the organisation’s intellectual capital.

The method is designed to be modular so that an organisation can choose to start at different levels depending on its readiness, needs and requirements.

In Stage I of "Strategic Planning for Knowledge Management" an organisation determines (i) the vision and readiness for a knowledge management initiative; and (ii) the scope and feasibility of the project. The main steps of Stage I are:

1. **Provide Leadership**
2. **Link knowledge management strategy with corporate strategy**
3. **Perform knowledge analysis**
4. **Assess risk and change readiness**
5. **Develop the case for KM**
6. **Obtain top management Approval**

In Stage II of "Developing the Knowledge Organisation" the structure and the design of a holistic solution (that covers processes, people and technology) are iteratively developed, tested and reviewed.

Stage III is the company-wide implementation of the KM initiative, while the Measurement part of the method aims to provide consistent support for measuring the creation, sharing and use of knowledge assets within the company.

3. An intranet-based tool that supports the collection and categorisation of internal and external information, the re-use of stored knowledge using flexible and customisable Knowledge Navigators and advanced search mechanisms that include keyword-based as well as concept-based searching (the latter supported by a graphical visualisation of the concepts organising the information space), and the collaboration via on-line workspaces that allow people to work together from different locations.

The three components of the Know-Net knowledge asset management solution – i.e. the framework, the method and the tool – have clear and consistent interdependencies, which exploit the knowledge-asset-centric nature of the solution and facilitate the amalgamation of the process-centric and product-centric perspectives to KM. Figure 3 highlights the overall interdependencies of the framework, method and tools.

The Know-Net framework can be used as an awareness tool as well as for developing a common language among the people of a company. The framework is useful as an enabler for discussing which are the critical knowledge areas, which ones are under-developed and
should be further enhanced and which are already valuable and should be protected and cultivated. In addition, the elements of the framework (strategy, structure, processes, systems) help share a first draft picture of the level of knowledge awareness within the company. Finally, the first discussions about KM should focus on the various levels for leveraging knowledge assets (i.e. individual, team, organisational and inter-organisational levels) in order to help identify possible areas for intervention. These rough analyses can provide useful input for the application of the Know-Net method (especially Stage I: Strategic Planning for Knowledge Management), as well as facilitate the smooth introduction of the concepts and terms used in the Know-Net tool.

The application of the method may be tightly linked to the use, customisation and roll-out of the Know-Net tool. In any case, however, each one of the two (method and tool) is also self-sustained and can be independently applied - actually, the method has already been applied to companies without the use of the tool.

Figure 3. Interdependencies of the Know-Net framework, method and tool

The coupling between the method and the tool is mainly accomplished through the eight modules of Stage II (Developing the Knowledge Organisation) of the Know-Net method. Each module of Stage II is a self-contained, value-adding entity and therefore not all modules are mandatory in a KM implementation. Ideally however, just as the Knowledge Assets are the main unifiers of our approach, Module 7 (Develop the Knowledge Asset Schema) acts as the frame of the Know-Net method that is being constructed with input from the ‘audit’ Modules 1, 3, and 5, while it supports the consistent execution of the ‘design/implement’ modules, 2, 4, and 6; see also Figure 4.
All ‘audit’ modules among other issues aim to identify in detail the Knowledge Assets, and corresponding Knowledge Objects and their attributes. Module 1 (Analyse Business Processes) for instance produces processes maps that depict key knowledge assets that are being used or created in selected business processes. Module 7 (Develop the Knowledge Asset Schema) collects this information, along with similar information from Modules 3 and 5, arranges possible overlappings, logically groups content, and creates the formal schema (Knowledge Asset Schema) on which the ‘design/implement’ modules are based. Consider another example: module 4 (Leverage Knowledge Networks) designs and organises communities of practice around the core Knowledge Assets of the organisation and proposes the already specified Knowledge Objects as units for knowledge representation within these communities.

6. Supporting Knowledge Networks

6.1. Knowledge Networks

Networks of people and networked organizations are emerging because the classic hierarchy of the bureaucratic model is slow to respond to the recent changes in the business environment. In the network, activities still need to be co-ordinated and integrated, but this integration relies on knowledge and relationships and a clear common sense of purpose. This has led to ideas about “work as a network of conversations” and the “hypertext organization”; see Nonaka and Takeuchi (1995). Networks may take various organisational forms, ranging from communities of practice between individuals with similar experiences and or purposes to supply chains of companies that exchange knowledge within their industry.

The levels of knowledge networking correspond to what Nonaka calls the “ontological dimension” in his model of organisations as knowledge creating mechanisms; see Nonaka (1994). This ontological dimension refers to the social interactions, which begin at the
individual level and then by communication between organisational boundaries let knowledge expand and grow-up.

According to Nonaka and Ray (1993) if new knowledge is relevant to the needs of the organization, it is likely to permeate through groups and divisions and thereby extend the community of interaction dealing with that knowledge. New knowledge that has a potential to support more advantageous ways of doing things is likely to be retained as a subject for further debate within the network and may also lead to an extension of the network. For example, what eventually proves to be a successful product might emanate from a R&D department and gradually acquire a greater circle of interested parties within the organization as the dimensions of its potential impact become more clear. As news of the emerging product travels beyond the organization, the circle will grow still wider embracing competitors, customers, firms dealing with complementary technologies and so on. Thus the network will go beyond the original "hard core" of knowledge creators to include those that are in some way affected by the exploitation of that knowledge.

However, there is no reason to suppose that there will be linear sequence of expansion – starting from the individual, progressing to the group and subsequently to the organization and beyond. The knowledge network could span departmental and organizational boundaries from the outset. Possible members of this community such as suppliers, customers and competitors might all enter the knowledge networks at any time.

We claim that such knowledge networks – either between individuals, or teams, or even organisations – are the principal organisational form for collective knowledge asset creation, sharing and application.

Knowledge networks are relationships among entities (individuals, teams, organisations) working on a common concern and they embed dynamism for collective and systematic knowledge asset creation and sharing. The structure of a knowledge network implies principles of coordination that not only enhance the individual capabilities of member entities, but themselves lead to capabilities that are not isolated to the network’s members. Cooperation can also engender capabilities in the relationship itself, such that the members develop principles of coordination that improve their joint performance. Or they might involve more complex rules governing the process by which innovations are collectively produced and shared. In this sense, the network is itself knowledge, not in the sense of providing access to distributed information and capabilities, but in representing a form of coordination guided by enduring principles of organization.

Knowledge networks have five critical characteristics that differentiate them from other similar organisational structures and mainly from communities of practice; see e.g. Wenger (1999) and Wenger and Snyder (2000). These characteristics are following:

- knowledge networks are responsible for creating, sharing, protecting and cultivating common knowledge assets;
- knowledge networks are working networks and they are purpose-driven;
- knowledge networks require organisational commitment beyond the commitment of their participating members;
• knowledge networks are built on expertise, not just interest – or common practice – alone; and

• knowledge networks aim at the development and strengthening of the learning capacity of all members.

In the following we examine the use of the Know-Net solution in facilitating knowledge asset management across knowledge networks in a software development and systems integration company.

6.2. Case-study of a Software Firm

The company examined is the Greek software firm Delta-Singular. Delta-Singular specialises in standardised business software covering market requirements in financial, accounting, distribution, logistics, retail, human resource management, and e-commerce systems. In addition, the company provides solutions integration in large-scale projects for public utilities, telecommunication, aerospace and defence, transportation, and public administration organizations. The company operates in all markets of south and Eastern Europe, the Middle East and Asia market.

One of the most valuable commodities for Delta-Singular is the knowledge created within the R&D unit. The innovation originating from the R&D unit drives to a high degree the evolution of the company’s products and services. Members of the R&D unit as well as other employees from other units of the company form knowledge networks in a dynamic manner. in order to resolve specific technical problems. There was a need to develop a strategy for learning from the team experience, and organise the knowledge created in a methodological manner. The challenge was to realise effective mechanisms for knowledge management without imposing overhead to these highly dynamic, highly creative teams. The technical infrastructure had to be highly dynamic and adoptable, integrating with existing systems and information repositories.

The solution focused on knowledge networks as a collaborative structure that facilitates the creation and transfer of knowledge. The project addressed not only the creation of new networks from the ground up but also it built upon existing, informal, working networks. New roles, such as subject experts have been assigned to take responsibility for providing expert opinion and identifying the knowledge assets stemming from the common effort. Mechanisms for information collection during the knowledge network lifetime were put in place, ensuring quality and consistent documentation of knowledge. These mechanisms provided for knowledge transparency, i.e. ability to re-use knowledge identified in a specific project to other projects. Furthermore, the R&D unit put in place mechanisms and regulations for reviewing knowledge so that “aging” knowledge items are collected and disposed. The Know-Net methodology was used to support the launch of viable networks, the creation of relevant knowledge base, and the provision of ‘care and feeding’ for the networks’ growth.

Solution highlights – The R&D knowledge network

Two levels of knowledge networking have been identified in the Singular R&D unit as pertinent to the proposal preparing process (Figure 5): at the unit level collaboration happens within teams that work in specific R&D projects and there is informal social networking based on common background; at the company level networking takes place between employees from other units who are considered subject matter experts.
Knowledge leveraging within the two types of networks was addressed in two phases. At the R&D Unit level during the first phase the team was organised around a common repository that was used as a place where information regarding the unit’s work was stored and maintained. A procedure was adopted for users to deposit information that could be later retrieved from colleagues in accordance to their access rights to the document repository. A separate procedure was adopted for team members to ask questions for matters that are not found in the document repository. In this case, they sent their question to an e-mail account where the initiative coordinator assessed the question content and if considered appropriate it forwarded it to the subject matter expert who was responsible for that thematic area.

In order for the mechanism to be of real value, a number of steps had to be taken before installing the process. These steps included the identification of the Delta-Singular “universe of knowledge” and the selection of a group of “knowledge providers” who would be responsible for answering questions in their specific thematic area. Department heads identified the Delta-Singular universe of knowledge within their departments and this knowledge segmentation was used for recognizing an expert in each field (i.e., a subject matter expert). Once a question had been submitted to the e-mail account the initiative coordinator forwarded it to the appropriate subject matter expert. The expert responded to the initiative coordinator who had the responsibility for forwarding the response to the person who asked the question and simultaneously he/she updated the knowledge repository by posting the item in question or by making public the question published along with its response – in a Frequently Asked Questions format. The initiative coordinator maintained a log keeping mechanism that accounts for all knowledge requests submitted.

The subject matter expert provided descriptive keywords that were used from the initiative coordinator as file metadata for storing the information at the knowledge repository. The initiative coordinator updated the request database with the question submitted and its response according to the expert provided keywords. Finally, the book keeping mechanism was updated accordingly (i.e., response supplied within the pre-set time limit, etc). Based on the information stored in the database during the first phase, the second phase was implemented in the following steps: a new knowledge brokering mechanism was established.

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**Figure 5. Knowledge networks within the R&D unit**

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and the information recorded in the database was made available through a company-wide intranet that made use of the Know-Net tool.

The knowledge brokering system utilized in the second phase abides to the same general characteristics as those adopted during the first phase. It is the platform functionality offered by the Know-Net tool that enhanced user access to the new corporate portal. The system general characteristics are briefly outlined as:

- The knowledge stored in the database is placed in a company-wide intranet that is implemented with the Know-Net platform.

- It is categorized according to knowledge assets identified through the implementation of the Know-Net method.

- The identification of all subject matter experts along with their area of expertise has become available through the corporate portal.

- Users who do not find the response to their request in the corporate knowledge base, are encouraged to submit it directly to the appropriate subject matter expert via e-mail.

- Users are advised to consult first the knowledge base before addressing questions to the subject matter experts.

- Responses not existing in the knowledge base are deposited to it from the subject matter experts who have the responsibility for maintaining the knowledge base content.

- The need for a book keeping mechanism has been eliminated.

Three roles have been assigned to the knowledge network members in relation to their normal activities. These roles include the author who is a subject matter expert and is responsible not only for providing expert opinion but also for identifying the knowledge assets stemming from the common effort. All information collected is delegated to her/him who is in charge of documenting it according to pre-specified quality, consistency, and design standards. Apart from authors there are also viewers who have the right to examine the documents deposited within the common workspace and receive messages every time content of their interest has been updated. When they feel that certain pieces of information should be included in the repository they forward them to the author who is responsible for the specific thematic area and she/he decides upon publishing the document provided. There is also a system administrator who is responsible for maintaining the system integrity and ensuring its availability to the users.

The adopted approach facilitates the dynamic re-evaluation of the firm’s knowledge assets. It introduces the notion of value added processes that create experience (i.e., knowledge assets) to the company personnel. These elements are code samples, deliverables, technical troubleshooting, case studies, designs, and methodology components that are applicable in various projects. Making these knowledge assets identified in a specific project re-usable to other projects requires that the documented material is transparent.

The technical infrastructure implemented provides the technical means so that stored items are indexed and retrieved using a full-text search option to retrieve content and any associated properties (metadata searching). In addition, a semi-automatic categorization process assists
users in depositing and retrieving documents by associating them with specific categories that group similar documents. The same process was proven immensely useful when the documents already stored in the corporate file-structure were migrated to the web storage facility. It provided an automatic importation mechanism that expedited the migration process. Finally, a subscription service notifies users about new, or updated, information on topics that match their interests and have found their way into the corporate depository. This mechanism works through a User Profile where the independent user declares her/his preferences.

One year after the launch of the initiative, the creators are positive about their work, since knowledge management has become an integral part of the strategy of Delta-Singular. The knowledge management infrastructure put in place allowed for:

- Savings in cost; e.g. by re-using knowledge on how to tackle specific software development problems.
- Increased returns, e.g. by maximising re-use and exploitation of software approaches, components and products.
- The alignment of research and development with product development requirements, by recognising important trends and developments worldwide.

7. Conclusions

The management of organisational knowledge has drawn the attention of academics, consultants and practitioners as a key lever for improving performance, boosting productivity and creativity and facilitating innovation in organisational settings. The methods, tools and the actual KM implementations in various companies have mainly followed one of two perspectives, which in this paper we called the process-centric and the product-centric approach. The former is primarily people-based and treats KM as a social communication process; the latter is mostly content-based and focuses on knowledge-related artefacts.

In this paper we presented a knowledge asset-based approach that fuses these two perspectives in a balanced manner. Our approach builds upon and extends the resource-based view of the firm by explicitly treating knowledge assets as the main driver for innovation and learning.

The integration of the product- and process-centric approaches can be seen in the case presented. The case of Delta-Singular demonstrates how both the process approach (i.e. dealing with knowledge networks) and the product approach (i.e. dealing with knowledge as an object that is consumed or produced during R&D projects) can interoperate in practice.

It is important to stress that our approach aims to ensure that both the process-centric view and the product-centric perspective can inter-operate, in the sense that they are not isolated from one another and that one can make use and add value to the other. The aim is not – and should not be – for all organisations to try to excel in both approaches at equal proportions. Such an attempt may not be in line with the business environment and could be overwhelming (in terms of resources and organisational and cultural changes needed) for an organisation (Hansen et. al., 1999).
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