

NEW INNOVATION MANAGEMENT PARADIGMS IN THE KNOWLEDGE- DRIVEN ECONOMY

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The growing importance of knowledge as a production factor and as a determinant of innovation can be explained by the continuous accumulation of technical knowledge over time. Innovation Management Techniques (IMTs) are critical to support the process of innovation in firms and help them in a systematic way to meet new market challenges.

1. Introduction: The knowledge economy

The paradigm of the knowledge economy originally appeared as a result of new trends and categories of data in the economy (Machlup, 1962). In the mid-1990s, the concept evolved referring to two presumed characteristics of the new economy: knowledge is more relevant, quantitatively and qualitatively, and second, the applications of information and communication technologies are driving the new economy (David and Foray, 1995). The OECD (1996) defines knowledge-based economies as “*economies, which are directly based on the production, distribution and use of*

knowledge and information.” Thus, the knowledge economy is based on an efficient system of knowledge access and distribution, as a *sine qua non* condition for increasing the amount of innovative opportunities (Godin, 2003).

This increasing importance of knowledge is changing the way firms compete as well as the sources of competitive advantage between countries. For the leading countries in the world economy, the balance between knowledge and resources has shifted so much towards the former that knowledge has become one of the most important determinants of the standard of living (World Bank, 1998). Today’s most technologically advanced economies are knowledge-based in the sense that knowledge is increasingly considered to be a commodity (Boulding, 1996), that advances in ICTs (Information and Communication Technologies) have reduced the cost of many aspects of knowledge activity (Howells, 2000), and the degree of connectivity between knowledge agents has increased dramatically (Aridor *et al*, 2000).

The paper has three basic objectives:

1. To provide a comprehensive review of the scope, characteristics, trends and business relevance of the main innovation management methodologies developed by significant actors in this field (those seeking to provide advice to firms and focused on knowledge as the most important benefit to a firm) across the European Union, USA and Japan.
2. To clarify a conceptual framework in this area and to facilitate a consensus among the relevant actors developing and using these methodologies.
3. To analyze the perceptions of various key players – the promoters and users of such methodologies.

The methodology followed in this research is based both on a literature research and a survey carried out of a balanced sample (geographically and activity wise) of firms, academic centers, business schools, consulting firms and business support organizations. The research was financed by the European Commission and was carried out among respondents from the 15 Member States of the European Union, Japan and the United States. In total, 433 completed questionnaires were

returned. The information collected from the survey was completed via phone interviews with the most representative stakeholders, which went into more detail on certain issues of relevance for the study and clarified some outstanding questions.

2. Knowledge and innovation management

The conception of innovation has evolved significantly over the last forty years. During the 1950s, innovation was considered a discrete development resulting from studies carried out by isolated researchers. Nowadays, innovation is no longer conceived as a specific result of individual actions, but more as a problem-solving process (Dosi, 1982), an interactive process involving relationships between firms with different actors (Kline and Rosenberg, 1986), a diversified learning process (Cohen and Levinthal, 1990), a process involving the exchange of codified and tacit knowledge (Patel and Pavitt, 1994), and an interactive process of learning and exchange where interdependence between actors generates an innovative system or an innovation cluster (Edquist, 1997). Other authors (Garcia and Calantone, 2002; McDermott and O'Connor, 2002) have outlined other aspects of innovation more related to the final consumer of the innovation and to the innovation process itself.

The evolution from a technological network perspective of innovation management to a social network perspective has been led by the challenge to transform information into knowledge (e.g. information contextually connected to the development or improvement of products or processes). Knowledge-based innovation requires the convergence of many different kinds of knowledge retained by a variety of actors (Kipping and Engwall, 2001; Smits and Moor, 2004).

The increasing importance of knowledge as an economic driver has major implications for innovation management, which is, in turn, a key determinant of national and regional competitiveness in the global, knowledge-driven economy. The contribution of

knowledge to innovation is achieved in part by reducing transaction costs between firms and other actors, most notably in the areas of research and information, buying and decision-making, policy and enforcement (Maskell, 1999).

Innovation and knowledge generation have been analysed from a specific systemic approach considering the market role, the knowledge architecture and the innovation alternatives (process, product, radical, incremental) outlining a parallel comparison between both processes. The systemic approach to innovation recognizes that innovation and knowledge generation take place as a result of a variety of activities, many of them outside the formal research process. Knowledge is thus generated not just in universities and research centers, but also in a very wide variety of locations within the economy, and notably as a product (learning-by-doing) or of consumption (learning-by-using). In the current economic context, growth must mainly originate from increasing the productivity of knowledge work, and increasing this productivity is the most important contribution management can make (David and Foray, 1995; Kay, 1999).

In comparison to the traditional mechanical versus organic approach to management (Sine *et al*, 2006), these characteristics involve a fundamental change in the strategic perception of the organization, which accordingly has to consider the following management challenges: to manage human capabilities in a strategic manner (Lengnick-Hall, 2002), to generate networks with internal and external partners (Pittaway *et al*, 2004), to create adaptive and interactive organizational structures and to balance individual and corporate motivation (Gioia *et al*, 2000).

Finally, the challenges of the new knowledge-driven economy can be classified into the following groups:

New characteristics of the market. The market is constantly changing, it is becoming more global and new competitors are emerging. In addition technology complexity is increasing, product life-cycles are shortening, and knowledge is consolidating as a crucial input.

New types of innovation. Innovation takes many forms. It emerges where the market offers incentives to introduce new products and production methods, and where people are willing to take risks and experiment with new ideas (Tidd *et al*, 2005).

New needs of stakeholders. Customers, owners and stock markets increasingly equate an organization's worth with its ability to get winning products to market on time, every time (Magleby and Todd, 2005).

New approach to innovation management. The capacity of a firm to implement innovation management revolves around its success in dealing with these two main challenges, top-line growth and bottom-line efficiency (Aggeri and Segrestin, 2007).

New technology innovation assessment skills. The rapid development of new technologies prompts firms to assess and implement the most appropriate technology according to their need to keep their competitiveness (Libutti, 2000).

Need for new innovation management tools. The development of knowledge-based innovation management requires the capacity to implement technical and relational tools. Technical tools refer to the acquisition and utilization of new information and communication technologies – they do not create competitive advantage because they are readily available to others. The creation of competitive advantage rests in relational tools – the way of doing business, both in the internal and external environments of firms (Lengrand and Chartrie, 1999; Hidalgo, 2004; Thomke, 2006).

3. Innovation management techniques

Innovation does not always mean employing the very latest cutting-edge technology. On the contrary, it is less a question of technology and more a way of thinking and finding creative solutions within the company. In this context, innovation management techniques (IMTs) can be seen as a range of tools, techniques and methodologies that help companies to adapt to

circumstances and meet market challenges in a systematic way (Cordero, 1991; Hidalgo, 2004).

In innovation management, there are a wide range of IMTs available on the market. This study focused on IMTs that complied with the following parameters:

1. They were sufficiently *developed and standardized*, and had fairly systematic methods of application. In other words, the implementation procedures and the benefits for the IMT were generally known and recognized in the market.
2. They are aimed at improving the competitiveness of firms by *focusing on knowledge* as the most important benefit.
3. They were *freely accessible* and not subject to any copyright or licensing agreement.

The application of a group of selection criteria resulted in ten groups of IMTs called “IMT typologies”. The table 1 summarizes the 10 IMT typologies and their associated methodologies/tools.

There is no single correlation between a firm’s specific business problem and the methodology that solves it. As a result, it cannot be claimed that there is a closed set of developed and proven IMTs for solving all challenges faced by business as a whole. Furthermore, IMTs do not usually act in a deterministic, unique manner and the diversity of firms and business circumstances means that there is not a single ideal model for innovation management, though there are some principles of good practice.

For these reasons, an innovation management technique cannot be considered in isolation. The usefulness of one IMT for a particular business challenge is normally measured in combination with other IMTs, this combination being adapted to varying degrees for each specific case. The benefit gained by the company depends on a combination of IMTs and the firm itself, and the mix of these two elements is what determines an effective outcome.

Table 1. IMT typologies and associated methodologies.

IMT typologies	Methodologies and tools
Knowledge management tools	<ul style="list-style-type: none"> Knowledge Audits Knowledge Mapping Document Management IPR Management
Market intelligence techniques	<ul style="list-style-type: none"> Technology Watch Patents Analysis Business Intelligence Customer Relationship Management Geo-marketing
Cooperative and networking tools	<ul style="list-style-type: none"> Groupware Team-building Supply Chain Management Industrial Clustering
Human resources management techniques	<ul style="list-style-type: none"> Teleworking Corporate Intranets On-line Recruitment e-Learning Competence Management
Interface management approaches	<ul style="list-style-type: none"> Marketing Interface Management Concurrent Engineering
Creativity development techniques	<ul style="list-style-type: none"> Brainstorming Lateral Thinking TRIZ Scamper Method Mind Mapping
Process improvement techniques	<ul style="list-style-type: none"> Benchmarking Workflow Business Process Re-engineering Just in Time
Innovation project management techniques	<ul style="list-style-type: none"> Project Management Project Appraisal Project Portfolio Management
Design management tools	<ul style="list-style-type: none"> CAD Systems Rapid Prototyping Usability Approaches Value Analysis
Business creation tools	<ul style="list-style-type: none"> Business Simulation Business Plan Spin-off (from research to market)

4. Key perceptions from the leading actors

4.1 Role of each actor

For the purpose of the study, “major actors” were defined as those bodies that play an important role in the development and/or promotion of methodologies to support innovation management in the knowledge-driven economy. These actors were classified into four groups: Business schools, Consultancies, Academic Centers and Research and Technology Organizations (RTOs), and Business Support Organizations (BSOs).

The study produced the following overall views on the roles of the major actors:

Academic Centers, including Research and Technology Organizations (RTOs), are *promoters* of IMTs and, in some specific cases, *developers* of them. In that case, they only adapt specific tools for SMEs. Their capacity to develop IMTs is concentrated sometimes in the development of strategies to raise the level of R&D activity among local or regional governments and some evaluation of R&D public programs.

Business schools are *developers* and *promoters* of IMTs. From the development perspective, it is the academic specialists with a high research orientation and high specialization that integrate business schools, because many of them develop part of their research activity directly in academic centers and combine academic and research work with consulting activities. As promoters, business schools use a great deal of tools. The most interesting mechanisms used to disseminate methodologies are the organization of seminars and workshops.

Consultancy firms consider themselves *more as developers than promoters* of IMTs and, for that reason, some of them in Europe were founded to support the regional economy or to diversify national economic activities. Some individual consultancy firms stressed the importance of motivation. These firms considered it one of their main objectives to motivate people to run their business, and to motivate SMEs to diversify activities.

Business Support Organizations are *promoters and users* of IMTs: they make available some tools to the SME members of their organization. They also act as a link between SMEs and innovation consultants and try to encourage the use of IMTs among third-party organizations. BSOs also consider themselves as *developers* of IMTs, but only when adapting IMTs in cooperation with consultants.

The opinion of managers within the companies was that consultancies are the main actors promoting the use of IMTs (27%), jointly with business schools (20%), and business support organizations (20%). With respect to helping firms use IMTs, consultancies are seen as the major agents (41%), while business schools (16%) and BSOs (15%) have less importance. The companies themselves consider their role to be more as *users* than *developers* of such methodologies.

All the major actors agree that only a few IMTs are widely recognized, and most are unidentifiable and inaccessible by firms. Over 37% of the actors declared that most firms are not aware of the existence of IMTs, while 34% stated that few IMTs are sufficiently defined to be successfully applied within firms. Consultancy firms and business schools generally believe that most firms are not aware of the existence of IMTs. Academic centers and industry generally see IMTs as systematically applied only in firms that want to be market leaders. Business support organizations mostly believe that very few IMTs are sufficiently well defined to be successfully applied within firms. All actors are convinced that new challenges coming from the knowledge-driven economy require new IMTs.

4.2 Difficulties and challenges in facing the knowledge-driven economy

The main difficulties seemed to revolve around the fact that introducing an IMT within an organization means an extra effort that requires time, motivation and money. The challenge is to motivate management support, to think of the future and foster creativity, to install a culture of innovation, to formulate an

innovation strategy, to implement the innovation process and to overcome the pressure for meeting quarterly results in preventing experimentation.

IMTs are sometimes considered to have a more academic than practical role, because they are subject to a lack of awareness and motivation, and consequently a widespread ignorance about how IMTs can help companies to survive in the new knowledge-driven economy. On the other hand, many actors stressed the lack of an innovative culture in firms, as well as the uncertainty in predicting the conditions for competitive performance in new markets. Another difficulty is that innovation management cannot be handled as a product or as production management. The reason is that many firms do not have the capacity to identify innovations and introduce them into the normal production process. Further difficulties include: bureaucratic complexity, low awareness of innovation technology amongst managers, lack of suitable metrics, and unwillingness to share knowledge.

From the challenges point of view, actors highlighted four specific areas as presenting the greatest obstacles: financial investment needed, difficulty of accepting failure, excessive bureaucracy and uncertainty, and the need to support training schemes and to overcome intercultural complications, particularly when knowledge sharing is necessary.

5. Business relevance of IMTs

In the knowledge economy, products and companies live or die by information – the most successful companies are those that use their intangible assets better and faster. Corporate reporting is still founded on a financial and management accounting model. This model was developed for the industrial economy and is not able to deal with today's knowledge economy, where most corporate value creation is based on knowledge assets rather than on physical resources and financial capital.

As a means of quantifying the business relevance of the different IMTs, the survey questionnaire detailed a list of benefits for the IMTs that respondent were invited to evaluate. The list of

benefits is as follows: increasing flexibility and efficiency, managing knowledge effectively, increasing productivity and reducing time to market, facilitating teamwork, enabling online gathering of marketing information, improving relationships with suppliers, integrating differing sources of customer information, making client relationships more effective, eliminating redundant processes, reducing costs by implementing IT-based solutions, reducing bureaucratic tasks (those that did not add value), using e-learning, exploring e-commerce, increasing the market range of goods and services, and improving relationships with employees.

The Business schools point of view is that the main advantages that IMTs give firms are increased flexibility and efficiency, an understanding about how to use e-learning, facilitated teamwork and improved gathering of on-line marketing information (Fig. 1). Business schools consider creativity development, business plan development, e-learning techniques and customer relationship management (CRM) as the IMTs most used within their organizations.

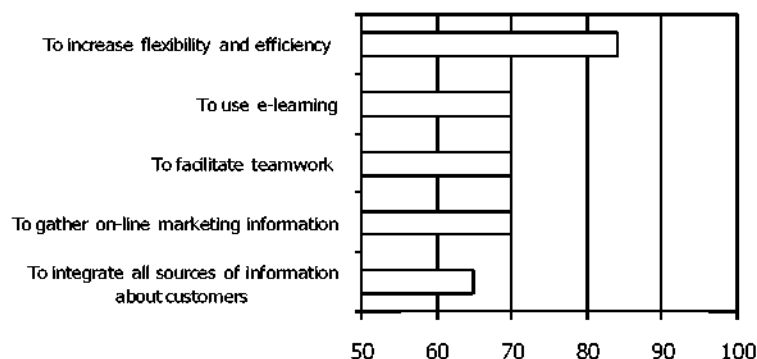


Figure1: Business relevance for Business Schools

From the perspective of the Academic centers, IMT benefits tend to be in the areas of managing knowledge effectively, reducing costs by using IT-based solutions, increased productivity and shorter time-to-market, increased flexibility and efficiency, better gathering of on-line market information, and improved

teamwork (Fig. 2). Project management, corporate intranet, spin-off and e-learning are the IMTs most successfully applied by the academic centers and RTOs.

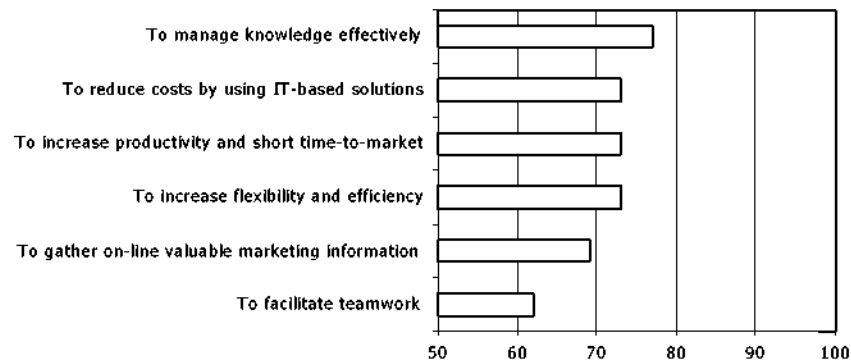


Figure 2: Business relevance for Academic Centres

Consultancy firms tend to the view that the most important benefits are managing knowledge effectively, increased flexibility and efficiency, facilitating teamwork, reduced bureaucratic tasks, increased productivity and improved relationships with suppliers (Fig. 3). Consultancies consider business plan development and project management as the IMTs most used within their organizations.

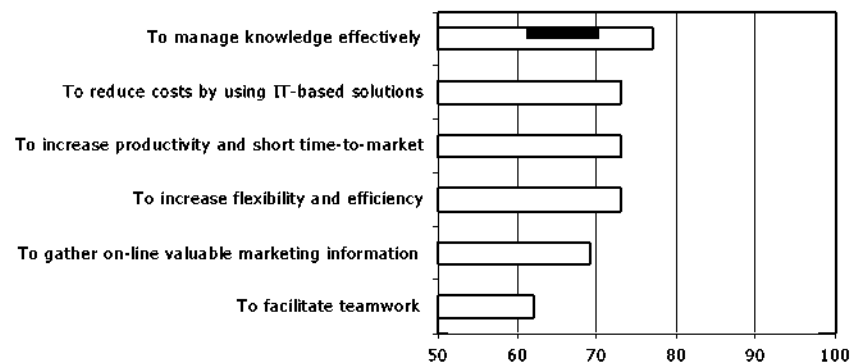


Figure 2: Business relevance for Academic Centres

From the perspective of BSOs, IMTs serve mainly to increase flexibility and efficiency, increase productivity and reduce time-to-market, gather on-line marketing information, manage knowledge effectively, and increase the effectiveness of relationships with suppliers (Fig. 4). BSOs are more oriented towards project management, corporate intranets, business plan development and outsourcing.

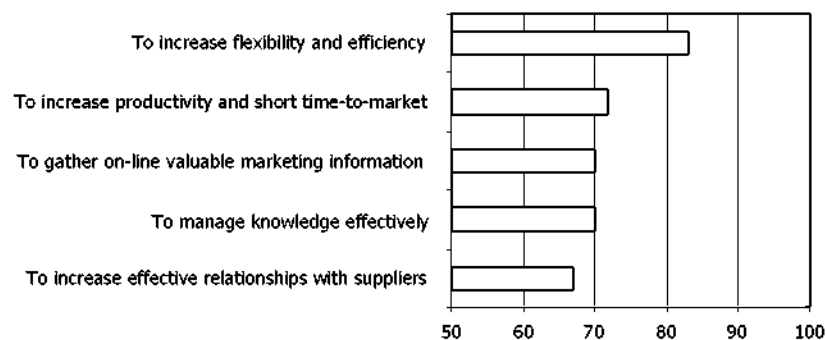


Figure 4: Business relevance for Business Support Organisations (BSOs)

Within the firms that actually implement IMTs, the perspective of the managers involved is that IMTs can help their firms to foster competitive advantages in the following ways: increasing flexibility and efficiency (86%), managing knowledge effectively (76%), improving productivity and time-to-market (73%), improving relationships with suppliers (72%), gathering on-line marketing information (69%), facilitating teamwork (67%), integrating different sources of customer information (66%), reducing costs by using IT-based solutions (65%), and eliminating redundant processes (64%).

Innovation is seen as a key business opportunity for many industrial partners, but not for all of them. For some managers, IMTs do not seem to be central to their business concerns. To them, the importance of IMTs would be part of their culture or overall approach to innovation; their appreciation of IMTs seems to be very superficial. They all agree to recognise that IMTs are not well known, not readily identifiable and are inaccessible.

On the other hand, the lack of a clear and homogeneous view of innovation makes it difficult to relate it to the knowledge economy; the

relationship between the two concepts is far from obvious and its relevance is not easy to demonstrate. In fact, managers are themselves asking for new inputs to better understand the extent and the scope of this question. Encouraging staff to disperse their acquired knowledge within the firm is a big challenge, and possibly one that can be encouraged within the knowledge-driven economy by application of technology-based tools to support this process.

6. Conclusions

The growing importance of knowledge as a production factor and as a determinant of innovation can be explained by the continuous accumulation of technical knowledge over time, and by the use of communications technologies that make that knowledge available very rapidly on a worldwide scale.

IMTs are critical to increasing the competitiveness. Participants in the study found that the main IMTs used were project management (82%), followed by business plan development (67%), corporate intranets (66%) and benchmarking (60%). Less used IMTs included Delphi method and lateral thinking. Some 43% of the actors in the study stated that they have successfully used IMTs in their own organization. Another 32% said that they do not use IMTs.

This study shows that proper application of IMTs facilitates a company's ability to introduce appropriate new technologies in products or processes, as well as the necessary changes to the organisation. However, most companies do not have an innovation culture that encourages the introduction of change within the organisation, more often there is a strong resistance from staff and sometimes from management. Companies can use consulting firms to get advice in this area, but generally have no tradition of asking consultancies for their help, a practice that has resulted in a limited range of operational models.

Finally, the following suggestions are intended to help promote an innovation culture, to assist companies to increase their

competitiveness through innovation, and to help take advantage of the opportunities of the knowledge-driven economy:

1. Set up an overall scheme together with national and regional governments to promote innovation management. The objective is to improve the know-how of actors promoting innovation management methodologies and tools within firms, in particular to SMEs. Also to promote the development of global networking among the various actors to encourage the exchange of knowledge and experience.
2. Support for well-designed awareness initiatives to enhance citizens' confidence in innovation as a means to foster competitiveness in companies and well being in our societies.
3. Support the development of common certification systems in innovation management. Certain preparatory work would be necessary to define practices and standards in this area.

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