

A Proposed Innovation Management System Framework – A Solution for Organizations Aimed for Obtaining Performance

Andreea Maier, Stelian Brad, Mircea Fulea, Diana Nicoară, and Dorin Maier

Abstract—Today, any organization - regardless of the specific activity - must be prepared to face continuous radical changes, innovation thus becoming a condition of survival in a globalized market.

Few managers have a wider vision that includes innovation, to enable better performance of the critical activities, namely the degree of novelty that it must submit an innovation to be considered as such. Companies need not only radical changes in the products or their services, but also to their business strategies. Not all managers have an overall view on the real size of necessary innovation potential. Unfortunately there is still no common understanding (and correct) of the term of innovation among managers. Moreover, not all managers are aware of the need for innovation. In these conditions, increasing the processes adaptability of firms (through innovation) to meet the needs and performance requirements is difficult without a systematic framework.

To overcome this disadvantage, the authors propose a framework for designing an innovation management system, to cover all the important aspects of a business system, to reach the actual performance of an organization.

Keywords—Innovation, innovation framework, innovation management system.

I. INTRODUCTION

THE increasing pressure on global competitiveness in recent years led to many challenges in managing innovation. First, technological advances are necessary to combine and accumulate the more dispersed knowledge available in various domains. Second, being competitive forces companies to accelerate development processes, in order to shorten product life cycles. Third, consumer preferences are getting increasingly diverse, resulting in more product models and variants that lead to smaller target markets and production units [1], [2].

In the last decade we have been witnessing global economic

F. Andreea Maier is PhD student in the Research Centre for Engineering and Management of Innovation (RESIN), Department of Engineering Design and Robotics, Faculty of Mechanical Engineering, Technical University of Cluj Napoca, Romania (e-mail: maier_andreea@ymail.com).

Stelian Brad, Prof. Dr., is the coordinator of the Research Centre for Engineering and Management of Innovation within the Technical University of Cluj-Napoca, Romania (e-mail: stelian.brad@staff.utcluj.ro).

Mircea Fulea, PhD, is a key member of the Research Centre for Engineering and Management of Innovation within the Technical University of Cluj-Napoca, Romania (e-mail: mircea.fulea@staff.utcluj.ro).

Diana Nicoară is PhD student in the Research Centre for Engineering and Management of Innovation (RESIN), Department of Engineering Design and Robotics, Faculty of Mechanical Engineering, Technical University of Cluj Napoca, Romania (e-mail: dannifeliss@gmail.com).

Dorin Maier is PhD student at Bucharest University of Economic Studies, Romania (e-mail:dorin.maier@gmail.com).

changes that led to a stream of innovative ideas and emerging technologies. The rate and propagation speed of technological development that spreads globally is astounding. Technology is present in every aspect of our lives. It changed the way we live and do business. Innovation and technology play a vital and critical role in the competitive global economy; therefore, they need to be properly integrated in the management workflow. Technology and innovation management has been defined as "the integration and effective use of innovation, strategic, operational, and commercial enterprises mission to gain a competitive edge"[3].

A. General Aspects of Management Systems

For an organization to be able to achieve success on a market where competition is becoming fiercer, it is necessary (for its performance) to grow and be officially recognized. Success can result from implementing and maintaining a management system that is designed to continuously improve performance, taking into account the needs of all stakeholders, and recognition of performance is given by system certification of the respective management system.

The concept of "management system" can be defined as a "organizational structure, responsibilities, procedures, practices, processes, activities and resources for developing, implementing, achieving and maintaining policies and objectives of an organization" [4]. Among the management systems, the most common are ISO 9001, ISO 14001, OHSAS 18001, and ISO 27001.

For a long time innovation was seen as a key factor for competitiveness for many companies [5], [6]. In order to systematize innovation, the innovation management system must be integrated into other existing management systems. In addition, it should be noted that - in terms of quality management – both the ISO 9001 and innovation management system stress the importance of two main pillars: *customer satisfaction* and *continuous improvement* [7], [8]. An innovation management system aims to improve the competitiveness of the organization through a planned and systematic management of the company's innovation processes, whether be it concerned with other products, production processes or marketing or organizational processes [9]. The success of a management system requires innovation: clearly defined objectives, an innovative culture, good communication, etc.

B. Limitations of Current Approaches

Based on the innovation management model proposed in [10] we emphasize its important components that form a

framework to manage organizational innovation. This framework aims to cover all the important aspects of a business system that can help identify the true performance in an organizational unit. In this context, the existing model can be seen as a range of tools, techniques and methodologies that help companies adapt to specific circumstances and market challenges in a systematic way (Fig. 1).

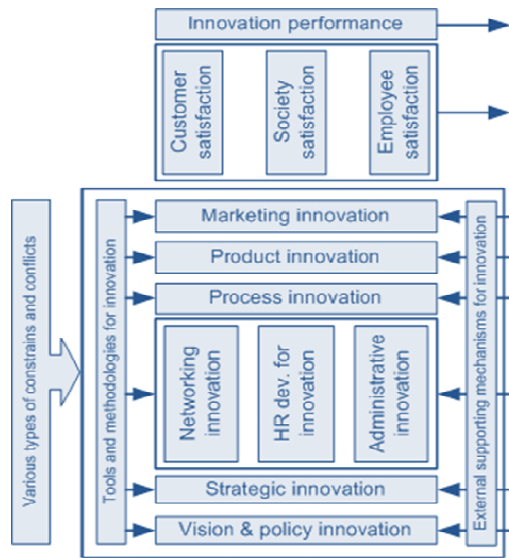


Fig. 1 Vertical integration of the multilayer innovation model (micro-system integration) (according to [10])

This model of innovation management involves five horizontal macro-systems of innovation, namely: the national innovation system, the regional innovation system, the organizational innovation, the system innovation and the individual innovation system. The five macro-innovation systems are interconnected and all work together to achieve convergence towards the overall objective. Each of the five macro-innovation systems consist of a set of eight micro-innovation systems which are vertically integrated as follows: vision and policy innovation, strategic innovation, innovation in networks, human resources development, innovation processes, product innovation, marketing innovation and innovation performance [10].

These micro-innovation systems are interconnected in a specific way, as seen in Fig. 1. To develop and apply mature micro-innovation systems, they must meet all stakeholder requirements (e.g. customers, society, employees) and achieve specific performance levels. All micro-innovation systems are supported by advanced tools and methodologies for innovation and by external mechanisms to other systems, and are subject to a complex set of (both technical and managerial) constraints and conflicts that must be addressed without compromise. For the specific case of the individual innovation system, the customer might be the company where one works, employees are convert into one's colleagues, products refer to the results of one's work, processes to the way of doing the work, HR development is related to the personal development in innovation management, and marketing to the way one "sells"

and promotes himself/herself. Moreover, each individual should have a vision in mind, and ways to approach the established target(s). The model shows that all stakeholders should innovate to achieve a high overall system performance. For each category of stakeholders, specific solutions for each innovation system must be developed [10].

II. BASIS FOR DEVELOPING AN INNOVATION MANAGEMENT SYSTEM FRAMEWORK

As basis for developing an Innovation Management System, we can use the Quality Management System ISO 9000. Its requirements are numerous and complex; in this sense, to develop an Innovation Management System can start with the requirements related to the customer satisfaction, to identify and analyze noncompliant products and services. By analyzing data obtained from ISO 9000 we can get the directions and opportunities towards which we should proceed with innovation. Another important aspect to consider when it comes to innovation is the fact that the best solutions often come as a result of collective knowledge.

A. Comparative Analysis between Principles of QMS and Principles of Innovation

In order to set the basis for an innovation management system we must do a analysis between principles of quality management system and the principles of innovation. According to the study of Vachhrajani (2008) the most widely used principles by SMEs would be the Eight Quality Management Principles developed by ISO. If we study carefully the principles of quality and innovation, as listed in Table I, we find that there are strong relationships between their various aspects. To highlight these relations, an analysis was carried out, in Fig. 2 using the graphical support of the QFD method. There is at least one strong relation on each row and each column of the matrix. This is clear evidence that quality management and innovation are two different streams of study, but they overlap in many aspects [11].

TABLE I
COMPARATIVE STUDY OF SMC AND INNOVATION PRINCIPLES FOR SMES
(TAKING WITH CHANGES FROM [11])

QMS Principles	Innovation Principles for SMEs
Customer focus	Empowerment
Leadership	Leadership
Involvement of people	Culture
Process approach	Technology
Systematic approach to management	Learning
Continual improvement	Structure
Factual approach to decision-making	Management
Mutually beneficial supplier relationship	

Needs \ CTQs	CTQs							Number of significant relationships
	1 Empowerment	2 Leadership	3 Culture	4 Technology	5 Learning	6 Structure	7 Management	
1 Customer focus			○	△	△	○	○	3
2 Leadership	○	⊕	△		△		○	3
3 Involvement of people	○	△	△		△		⊕	3
4 Process approach	○			△		○	○	3
5 Systematic approach to management	△					○	⊕	2
7 Continual improvement			○	○	○	△	○	4
8 Factual approach to decision-making	△	○	○		△	△	○	2
9 Mutually beneficial supplier relationship			○		△		○	2
Number of significant relationships	3	2	3	1	1	4	8	

Fig. 2 Analysis of links between the principles of SMC and those of innovation (using Qualica QFD)

For example, leadership is a common principle to the success of both innovation and quality. Developing an innovative culture in SMEs is a source of competitive advantages, leading to customer satisfaction and increasing the organization's focus on the customer. This is an obvious signal that the systematic management approach is essential for innovation. Also, acceptance of new technologies is an essential part of innovation [11].

B. Comparative Analysis between QMS and IMS

TABLE II
COMPARATIVE ANALYSIS BETWEEN THE QMS AND IMS

Management systems	QMS	IMS
To whom is addressed	QMS aims to meet customer needs	IMS aims to improve the competitiveness of the organization through planned and systematic management of the company's innovation process, whether it be concerned with other products, production processes or marketing or organizational processes
Contractual issues	Quality assurance activities are conducted in a contractual framework, being directly related to the client and the contract you signed with that organization	Innovation activities, aimed at meeting society is not held in a contractual framework (there is no contract with "society" as an entity)
Results pursued	Customer satisfaction through: - improvement of performance of products and services; - increased the level of compliance; - reduction in defects and scrap.	For innovation managers a management system provides: - Tools for review, storage and processing. - Improvement - Methods to avoid traps, or changes that would increase the value of ideas.

After we compare the principles of quality management system we can compare the two systems, in order to highlight

the difference between them. Table II summarizes the major differences between a Quality Management System (QMS) and a potential Innovation Management System (IMS).

C. A Proposal for an Innovation Management System Framework

The success of an Innovation Management System lies in its framework. A framework is required in any field in order to progress, as it gives a set of understandable and actionable principles. Most organizations will adopt an innovation methodology without having a solid framework; this can only lead to an accidental innovation.

In order to be (close to) ideal, an innovation management system framework should be useful to all types of organizations, whether large or small, public or private, and must necessarily address and organize a broad range of issues. This framework needs to manage a rigorous innovation progress; it requires specific tools and most of all it needs to remain simple and accessible.

After exploring many options available in the innovation field today, the authors propose a framework, illustrated in Fig. 3 that meets the conditions above mentioned, and represents a base for future development of an innovation management system.

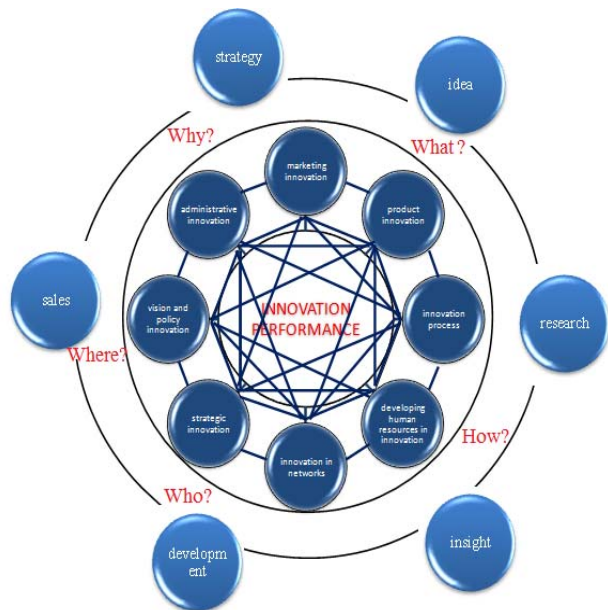


Fig. 3 The framework proposal for an innovating Management system

The framework supports the management of the simple but yet complex innovation process, stating a number of steps that an organization should take in order to succeed in innovation, while considering all the important aspects of a business system that can help identify the performance in the organizational unit.

In order to obtain the general innovation performance we need to divide the complex existing field of innovation, in an organization, in smaller parts. We divided innovation in eight

parts that are interconnected in a specific way; these parts are: vision and policy innovation, strategic innovation, innovation in networks, human resources development, innovation processes, product innovation, marketing innovation, and innovation performance.

Innovation in terms of local policies refers to new political and legislative measures that apply to a specific group, territory or community in order to bring significant improvements on specific features that define the sector. Innovation in terms of general policy refers to policy measures or new legislation, which applies to many groups, territories or communities to bring significant improvements to general characteristics [12].

Innovation in the strategic plan includes measures to develop new business models to ensure a competitive advantage for the organization, and reinventing the rules of competition. Strategic innovation is the term used in the literature to express the combination between innovation and strategy. Strategic innovation means the fundamental business models that reuse and reshape existing markets to achieve improved consumer values and massive development of companies [10].

Administrative innovation is the implementation of a significant change in business practices, workplace organization or in external relations, aiming to improve the innovative capacity of the firm or the performance characteristics such as quality, efficiency, workflow, etc. [13], [14], [15].

Success, performance and competitiveness of any organization depend largely on the content and quality of human resources management because the competitive advantage of an organization lies in its people. People are a shared resource and a vital resource equally to all organizations, regardless of the area in which they operate, a resource that ensures their competitive survival, development and success. Without the actual presence of people who know what, when and how to do it, it is simply impossible for organizations to achieve their goals [16], [17].

In general terms, process innovation is the implementation of a method of production or delivery of a new method which has been significantly improved [18]. This includes significant changes in techniques, equipment and / or software, intending to reduce production and distribution costs, improves quality, to produce or to distribute new or improved efficiency or flexibility of productive or supply activities and reduce environmental safety risks [19], [20], [21].

Product innovation is an activity of introduction in the market of goods, new or significantly improved services with respect to its characteristics or the introduction of user friendliness elements, components or subsystems. These include significant improvements in technical specifications, components and materials, incorporated software, introducing user-friendly elements or other functional characteristics. Unlike process innovations they are sold directly to customers [20], [21].

Innovation in marketing refers to significant changes in how the company markets and supports changes in design and

packaging for its products and services. Marketing innovation leads to major changes in product design and packaging, new product promotion and distribution methods, creates new brands, new sale methods, new pricing policies methods, new presentation methods, opens of new markets, etc. In order to succeed in the knowledge economy era and to promote their core competitive power, companies should make major efforts in developing marketing innovation [22].

All of the eight parts must achieve a specific performance level, and - to get this – the authors propose a set of steps that guide one through the innovation process. The starting points are the essential questions of innovation: “why?”, “what?”, “how?”, “who?” and “where?” do we innovate.

If we ask “why innovate?”, we know that innovation is a strategic necessity, since the purpose of innovation is to ensure that our organization will survive, and most of the evidence shows that any organization that does not innovate will not resist on the market. This question leads us to the first step of the innovation process, the plan or the strategy, where we define the specific intents and expectations and establish the way we will obtain the performance level that we expect. At this step is very important to establish the goal and the results but also we need to trace the main steps to get there.

If we ask “what to innovate?”, we recognize that the unpredictable nature of change requires us to prepare many innovative options for a range of possible future solutions. At this step we identify the innovative ideas that we need to develop. We need a lot of ideas to help us decide upon the best one to accept and develop.

If we ask “how to innovate?”, we understand that a rigorous process of innovation is essential. At this step we have the idea that we want to develop, but before it actually starts to be developed we need to have all the data, or at least as much of data possible regarding this idea. This step of research is very important considering that innovation refers to something new, something that we do not know how to obtain or to handle, so a difference of knowledge, between what we know now and what we need to know in order to innovate, occurs.

When we think of “who innovates?” we can notice that although everyone participates in creating a innovation culture, there are always people who set the tone to the innovative culture, who come up with great ideas and those who organize, implement and support innovation. At this step we develop the idea and transform it from vision to reality; this is a complex step that involves a lot of people into an interdisciplinary process that requires specific tools and infrastructure to support it. All the tools and the infrastructure are given by answering the “where” question. The final step is obtaining the desired results by a successful sale.

These steps are a cycle that does not end by getting the final results from the sale but it continues with another problem that requires innovation. This cycle can be applied simultaneously to each of the eight parts described above and can be applied at different stages for each of them.

The innovation framework can be easily integrated into an organization’s existing management systems as a core function. Having an effective and sustainable innovation

framework will minimize frustrations, risks, cost overruns and system failures associated with innovation activities.

III. CONCLUSION

The need for innovation is simple: changes are accelerating, which means that we don't know what's coming up in the future, which means more uncertainty, which means we'd better innovate to both prepare for changes and *make* changes. This framework for innovation management provides several advantages. A major benefit is given by the possibility to identify the degree of innovation at any time and in any sector of the organization. Another advantage obtained by using the proposed framework is the setup of an environment where innovation is a practice that occurs naturally and that involves every stakeholder in its process. Another benefit is the fact that the analysis of ideas leads not only to identifying strengths and weaknesses, but suggests ways to improve ideas, in order to increase the potential added value they might bring. This framework is the basis for further development of an innovation management system.

REFERENCES

- [1] R. C. Calia, F. M. Guerrini and G. L. Mourra, "Innovation networks: from technological development to business model reconfiguration", *Technovation*, vol. 27, no. 8, pp. 426-432, 2007.
- [2] R. Narula, "Understanding absorptive capacities in an "innovation systems" context consequences for economic and employment growth," *Druid Working Papers 04-02, DRUID*, Copenhagen Business School, Department of Industrial Economics and Strategy/Aalborg University, Department of Business Studies, 2004.
- [3] M. K. Badawy, "Is open innovation a field of study or a communication barrier to theory development?": A perspective, *Technovation*, vol. 31, no.1, pp. 65-67, 2010.
- [4] J. Tang, "Corporate Culture and Integrated Management Systems:-A case study of the UK Construction Industry", 2003.
- [5] S. Rossetto, "Quality and innovation: a conceptual model of their interaction", *Total Quality Management & Business Excellence*, vol. 6, no. 3, 1995.
- [6] M. P. Tuominen, M. P. 1999, "An analysis of innovation management systems' characteristics", *International Journal of Production Economics*, pp. 60, 1995.
- [7] M. Dragomir, "Cercetări și contribuții privind concepția, dezvoltarea, implementarea și îmbunătățirea continuă a sistemelor de management integrat al calității, mediului și sănătății și securității muncii în întreprinderile industriale", pp. 27, 2010.
- [8] S. Vinodh, "The case of implementing innovative total quality function deployment for preventing the sticking of the latching in electronic switches", *Production Planning & Control: The Management of Operations*, vol. 19, no. 8, 2008.
- [9] D. A. Coelho, J. C. Matias, "An Empirical Study on Integration of the Innovation", Wiesbaden, Germany: Proceedings of ERIMA, 5-11, 2010.
- [10] S. Brad, "Multilayer innovation", A Key Driver towards a Rapid Growth of Economic ompetitiveness: Challenges for Romania, Proceesings of the International Conference on Quality – Innovation - European Integration – QIEI 2008 "Special issue of the Journal "Calitatea- acces la success".
- [11] H. Vachhrajani, "A symbiosis of Quality and Innovation : Creating an integrated model for SMEs", *Quality Striving for Excellence*, National Centre for Quality Management, vol. 5, no. 6, 2008.
- [12] S. Brad, „The Product Manager's Handbook of Engineering and Management of Innovation”, Editura Economică, București, 2006.
- [13] Teece, "Dynamic Capabilities and Strategic Management", *Strategic Management Journal*, vol. 18, no. 7, pp. 509-533, 1980.
- [14] F. Damanpour, W. Evan, „Organizational innovation and performance: the problem of organizational lag”, *Administrative Science Quarterly*, pp. 392-409, 1984.
- [15] T. H. Davenport, "Process Innovation", 1992.
- [16] L. Anastasiu, "How the Changing of Technology Can Become a Motivating Factor in Human Resources Management", Proceedings on the 5th International Seminar Quality Management in Higher Education, Alexandroupolis, Greece, 2009.
- [17] L. Anastasiu, "The Impact of E-Learning on Human Resources Effectiveness in Higher Education", Proceedings on the 7th International Seminar Quality Management in Higher Education, Iasi, Romania, 2012.
- [18] Organisation for Economic Co-operation and Development (OECD), *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, The Measurement of Scientific and Technological Activities*, 2005
- [19] M. Westerlund, "Learning and innovation in inter-organizational network collaboration" *Journal of Business & Industrial Marketing*, vol. 25, no. 6, pp. 435–442, 2010.
- [20] *Metodologia privind statistica inovării*, București, 2009.
- [21] S. Leavengood, „Identifying Best Quality Management Practices for Achieving Quality and Innovation”, *Performance in the Forest Products Industry*, Portland State University, 2011.
- [22] S. Zhao, *Study on the Patterns of Marketing Innovation of Enterprise*, 2007.