

East African Scholars Journal of Economics, Business and Management

(An Open Access, International, Indexed, Peer-Reviewed Journal)

A Publication of East African Scholars Publisher, Kenya

www.easpublisher.com

Review Article

A Literature Review on Innovation Process

Wiebke Dieter¹, Wolfgang Schmitt*²

¹PhD student, International University of Applied Science, Bad Honnef Bonn, Germany,

²PhD student, Allensbach University, Konstanz, Germany

*Corresponding Author

Wolfgang Schmitt

Article History

Received: 10.12.2018 | Accepted: 22.12.2018 | Published: 30.12.2018 | DOI: 10.36349/easjebm.2018.v01i03.003

Abstract: The innovation process is a more and more approached topic in the literature. The reason for this is that innovation is a key element for the survival of an organization. The need for innovation is imperative, whether it's companies that have to fight for market share or profit, or public organizations that need to improve their services. This research presents the models of the innovation process as well as a perspective how the models of the innovation process have developed over time. In the course of industrial development, there have been a number of attempts to impose a certain conceptual order in the analysis of the innovation process in order to understand the nature and the way in which innovation activities are carried out and to provide a more secure basis for formulating innovation policies.

Keywords: innovation, innovation process, the models of the innovation process, competition

INTRODUCTION

The growing pressure of global competition has led to the emergence of more challenges in innovation management in recent years. First of all, technological advances make it necessary to combine and accumulate more knowledge dispersed in the fields of science. Secondly, competitive pressure forces companies to accelerate development processes to shorten product life cycles. Thirdly, consumer preferences are becoming increasingly diverse, resulting in several models and product variants that lead to target markets and smaller production units (Armas, 2005; Maier, 2013 a-d; Amza, 2010; Vlachaki, 2010, Maier, 2014).

The concept of innovation defines synthetically the introduction of the new. The actions of this purpose are part of man's life, not yesterday, today, finding and introducing the new one representing the main factors that have determined the evolution of mankind throughout its existence. The importance and volume of these activities increased with the development of society (Maier, 2012; Nicoară, 2013 a-b; Maier, 2017 a-b; Mel, 2009; Olaru, 2013 a-b).

Especially in the last decades there has been a phenomenal increase in the interest for innovation as a way of achieving sustainable economic growth of

organizations and society. At present, we are living in an accelerated transition period marked by complex and profound transformations in all areas of activity. The magnitude of innovation is reflected primarily in the high pace of the development of new products and technologies, but the changes do not just refer to tangible things (Maier, 2018 a-e; Matias, 2006; Popescu, 2016; Brad, 2006; Maier, 2016a-d; Vlachaki, 2010; Miller, 1999).

MODELS OF THE INNOVATION PROCESS AND THEIR EVOLUTION

This research does not claim to include all existing models, but provides a general insight into the variations that exist. Before discussing the various existing models, we are going a step back to see how the models of the innovation process have developed over time. In the course of industrial development, there have been a number of attempts to impose a certain conceptual order in the analysis of the innovation process in order to understand the nature and the way in which innovation activities are carried out and to provide a more secure basis for formulating innovation policies (Maier, 2018 f-g; Rothwell, 1994; Niek, 2006; Chris, 2010; Ribiere, 2010; Olaru, 2014; Vadastreanu, 2015a-c; Maier, 2013). Various models of the innovation process have been developed to allow us to order our thinking on innovation (Figure 1).

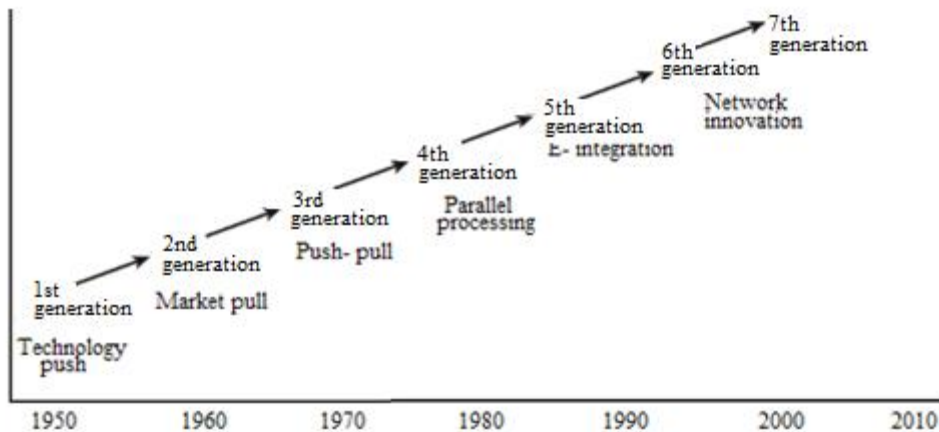


Figure 1. **Models of the innovation process and their evolution** (Maier, 2015 a-b; Maier, 2014)

As a rule, such models of the innovation process have been divided into several phases or stages that refer to basic (fundamental) research in which new scientific discoveries arise, applied research in which scientific breakthroughs are transformed through engineering design into engineering practical new products, processes, services; these new innovative technical and scientific achievements, as a result of production processes, are transformed into marketable goods that are disseminated within the economy.

Roy Rothwell has identified five generations of innovation process models that reveal the stages of evolution of the economic reality and economic thinking of the community of scientists (Hobday, 2005; Tidd, 1998; Tidd, 2001 a-b; Tidd, 2006; Maier, 2017 a-b; Kiehne, 2016; Roberts, 2007).

The first generation of linear models, which were prevalent between the 1950s and 1960s, was "technology push" considering technological innovations to emerge under the impetus of R & D : the innovation process begins with a scientific discovery (fundamental research), goes through an invention that is then capitalized through engineering design and production activities and ends with marketing and selling the new innovative product or the new innovative process that are " pushed "into the market.

In this approach, it is therefore considered that the innovation process consists of sequential, distinct conceptual and temporal phases, characterized by uni-directional relations (without feedback). Phases of the "technology push" innovation model are shown in Figure 2

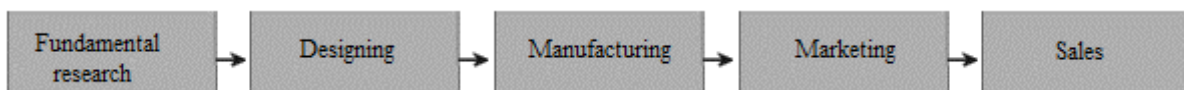


Figure 2. **Linear innovation model "technology push"** (Rothwell, 1992; Rothwell,1994; Niek, 2006; Chris, 2010; Ribiere, 2010, Maier, 2018 a-e)

The probability of innovation success achieved in "technology push" is the product of the probability of technological success and the likelihood of commercial success for that innovative technology (Le Corre, 2006; Gann, 2007; Galanakis, 2006).

The second generation of models emerged in the late 1960s and early 1970s, being called "market

pull". These models are also linear and assume that innovations derive from a perceived market demand that influences the direction and rate of technological development, and research and development only has a reactive role in the innovation process. The orientation of the whole innovation process is to meet consumer demands. The phases of the "market pull" model are shown in Figure 3.



Figure 3. **Linear Innovation Model "market pull"** (Rothwell, 1992; Rothwell,1994; Niek, 2006; Chris, 2010; Ribiere, 2010, Maier, 2018 a-e)

Both linear models have been subjected to a series of criticisms because they were very simplified representations that distort the reality of the innovation process, a process that is not linear, but it is affected by feedback loops between the ongoing phases.

The third generation of models is represented by the so-called "coupling" innovation process, which can be seen as a combination of "technology push" and

"market pull". The "coupled" innovation process is sequentially logically, although not necessarily continuous, and can be divided into distinctly interdependent phases, but interacting through feedback to the previous stage. The model suggests that vendors and customers need to be tightly "coupled" into integrated product development teams. Figure 4 illustrates a "coupled" innovation model.

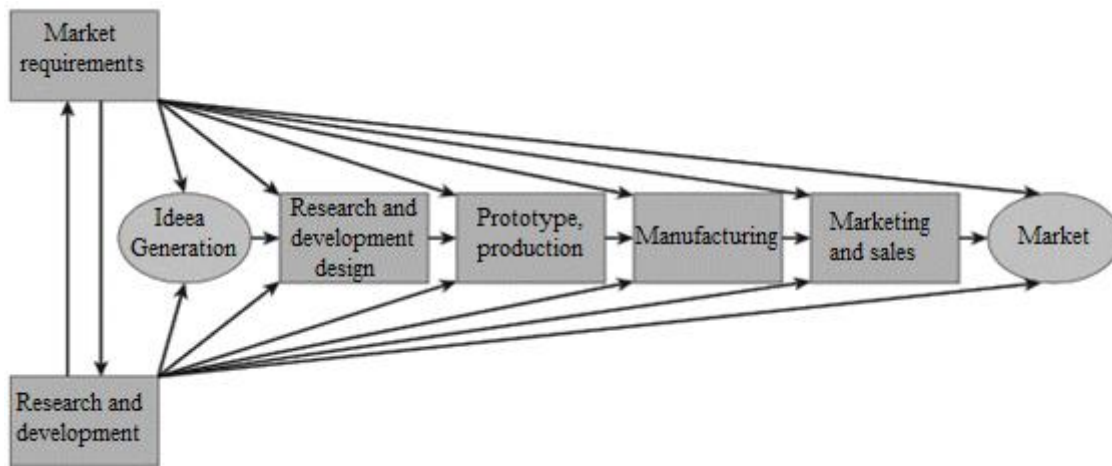


Figure 4. Innovation model of "coupling" type
(Rothwell, 1992; Rothwell,1994; Niek, 2006; Chris, 2010; Ribiere, 2010, Maier, 2018 a-e)

The fourth generation of models (1980s - early 1990s) were called *models of functionally integrated innovation processes* (Figure 5) and is characterized by the integration and development of parallel (simultaneous) products instead of the sequential involvement mode of the company's departments that are responsible for designing and developing new

products. Fourth generation models reveal complex iterations, reaction loops, and reciprocal relationships between marketing, R & D, operations, distribution. The innovation process now recognizes the role that can be played by alliances with other firms and competitors (Galanakis, 2006).

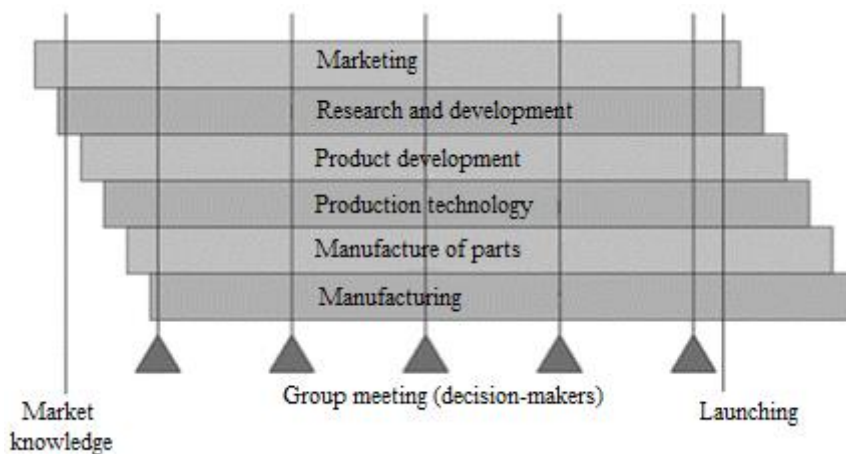


Figure 5. Models of innovation processes that are functionally integrated
(Rothwell, 1992; Rothwell,1994; Niek, 2006; Chris, 2010; Ribiere, 2010, Maier, 2018 a-e)

The fifth generation of models (Figure 6), introduced in the 1990s, is *system integration processes and network innovation*. These models are based on greater overall integration of systems and organizations,

on the formation of collaborative networks of innovative actors, consisting of key suppliers, customers, other industrial companies, universities, communities to which firms are involved, etc. in order

to take advantage of combining technologies and solve the complexity problems of new products. The fifth-generation innovation process is a response to high levels of risk and uncertainty in innovation (Gann,

2007). Within companies, there is an increasing focus on the use of best practices and organizational forms, allowing maximum flexibility and sensitivity to unpredictable and turbulent markets.

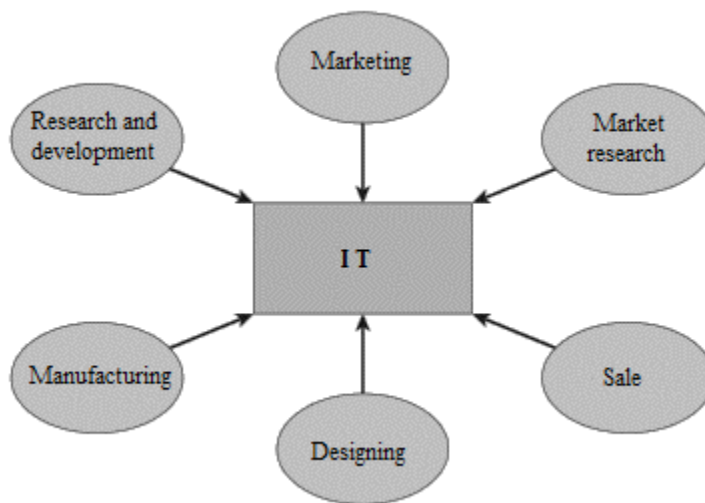


Figure 6. **Network Innovation Process Model** (Rothwell, 1992; Rothwell,1994; Niek, 2006; Chris, 2010; Ribiere, 2010, Maier, 2018 a-e)

Gann (2007) believes that a sixth generation innovation process can be identified, which is driven by increased opportunities for the use of creativity and ideas distributed among the various actors inside and outside the company, as well as optimization by simulation and modeling not only the creation and dissemination of new products, services and processes

through which they are produced and delivered, as well as the most effective strategies for delivering value.

Ribiere (2010) presents a new innovation model, which is no longer a linear model but a cyclical innovation model, as described in Figure 7.

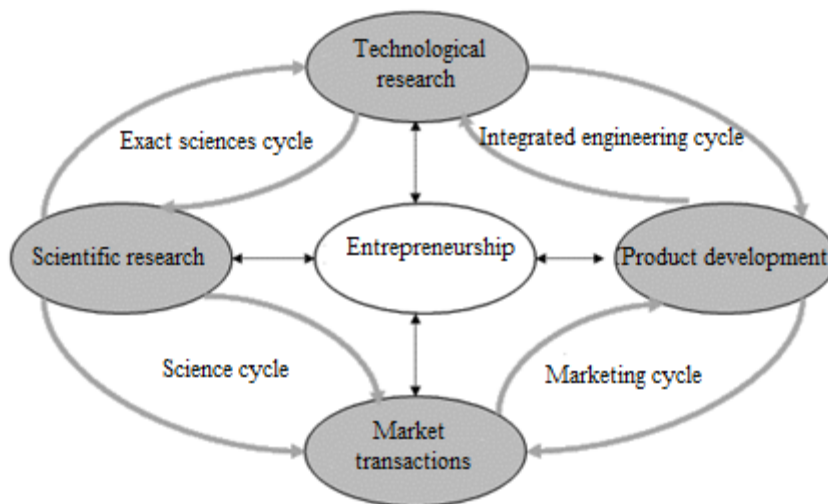


Figure 7. **Cyclical innovation model** (Ribiere, 2010, Maier, 2018 a-e)

This model is built on four main components: scientific research, technological research, product development and market transitions. Each component influences and is influenced by its adjacent components. For example, technological research is driven by new technology breakthroughs and new market pulls. Such models add to the previous models, increase the level of

interaction of the various parties involved and ensure a more dynamic process that allows organizations to start and adjust quickly. The Cyclical Innovation Model demonstrates that successful innovation requires contributions to all four quadrants (Ribiere, 2010).

Maier (2012) presents a new model that manages a rigorous innovation process and proposed 5 steps to guide us in the innovation process (Figure 8).

As a starting point in the process of innovation are the essential questions of innovation: "why", "what", "how", "who" and "where" we innovate?

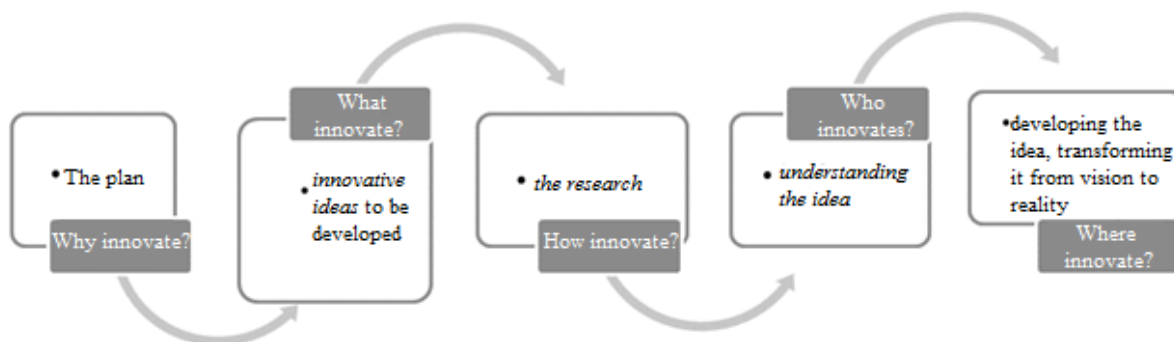


Figure 8. Model of the innovation process (Maier, 2012)

If we ask, "Why are we innovating?" we know that innovation is a strategic necessity, because the aim of innovation is to ensure that our organization will survive; most evidence shows that any organization that does not innovate will not resist the market. This question leads us to the first step of the innovation process, plan or strategy, in which we will define specific intentions and expectations and determine how we will achieve the expected performance level. At this step it is very important to set the purpose and the results, but we also need to follow the main steps to get there.

The second question, "What do we innovate?", We recognize the unpredictable nature of change, which requires the preparation of several innovative options for a range of possible solutions in the future. This question corresponds to step two. At this step we will identify the innovative ideas that we need to develop. We need a lot of ideas to decide the best idea to develop.

By asking "How do we innovate?", We need to understand that a rigorous innovation process is essential. By addressing this question, we move to step three - research. At this point, we have the idea we want to develop, but before we actually start, we need to have all the data, or at least all the possible data on this idea. This research step is very important given that innovation is about something new, something we do not know how to get or manage, so there is a difference in knowledge between what we now know and what we need to know to innovate.

When we think about "Who Innovates?", We notice that although everyone is participating in creating an innovation culture, there are always people who give the tone to the innovative culture that come with great ideas and who organize, implement and support innovation. This question corresponds to step four - understanding the idea, immediately going to step

five. At this step we will develop the idea and turn it from vision into reality. This is a complex approach, involving a lot of people in an interdisciplinary process that requires specific tools and infrastructure to support it. All tools and infrastructure are given by asking "Where do we innovate?" The final step of selling / capitalizing, is to get the desired results through a successful sale / capitalization. These steps form a cycle that does not end by obtaining the final sales / capitalization results, but continues with another problem that requires an innovative approach.

CONCLUSIONS

As the economic environment becomes more and more dynamic, with specific behavior, complex, nonlinear and adaptive, a new challenge faces the organizations: innovation as an essential part of everyday activities. If, some time ago, quality and productivity were key elements to ensure the completeness of an organization, nowadays, and even more so in the future, achieving this goal involves adding to the competitiveness equation and the parameter called innovation. Innovation is considered to be the engine of an organization's growth.

REFERENCES

- 1 Amza, V. D. (2010). Dezvoltarea managementului inovării ca parte integrantă a managementului strategic al firmei., Academia de Studii Economice, București
- 2 Armas, I. (2005), *Ideii-ghid pentru consultanța în domeniul managementului inovării*, Economia seria Management, 7(2)
- 3 Brad, S. (2006), *Manualul de Bază al Managerului de Proiect în Ingineria și Managementul Inovației*, Ed. Economică, București
- 4 Chris, E. (2010), *Innovation management; a management literature review of innovation processes models and their implications*

- 5 Galanakis, K. (2006), *Innovation process*, Make sense using systems thinking, *Technovation*, 26(1222–1232).
- 6 Gann, D., Dodgson, M. (2007), *Innovation Technology: How New Technologies Are Changing The Way We Innovate*, National Endowment for Science, Technology and the Arts, London.
- 7 Hobday, M. (2005), *Firm-level Innovation Models: Perspectives on Research in Developed and Developing Countries*, *Technology Analysis & Strategic Management*, 17(2),121–146
- 8 Kiehne, J. Olaru M, Sven, J, Maier D. (2016), *Does Globalization drive Innovation? Evidence from the European Union*, International Conference on Production Research - Regional Conference Africa, Europe and The Middle East (Icpr-Aem 2016) and 4th International Conference on Quality and Innovation in Engineering and Management (QIEM 2016), Joule 25-30, Cluj-Napoca, Romania
- 9 Le Corre, A., Mischke, G. (2006), *The Innovation Game. A New Approach to Innovation Management and R&D*, Springer US
- 10 Maier A., Brad S., Fulea M., Nicoară D., Maier D. (2012), *A proposed innovation management system Framework - A solution for organizations aimed for obtaining performance*, International Conference on Management, Business, Economics and Finance, 28-29 November 2012, Paris
- 11 Maier A., Brad S., Nicoară D., Maier D. (2013a), *Business Success through Innovation Management; a Literature Review of Innovation Process Models*, International Conference on Economics, Business and Marketing Management, February 27-28, 2013, Barcelona, Spain
- 12 Maier A., Brad, S., Nicoară, D., Maier D. (2013b), *Innovation by developing human resources, ensuring the competitiveness and success of the organization*, Proceedings of 2nd World Conference on Business, Economics and Management–BEM 2013, April 25 – 28 2013, Antalya, Turkey
- 13 Maier A., Keppler T., Maier D. (2014), *Innovation the new trend in today's challenging economy*, The 13th International Conference on Informatics în Economy, IE 2014, 15-18 May 2014, București, România
- 14 Maier A., Nicoară D, Maier D., Suarasan M, Anastasiu A. (2013c), *Achieving performance in an organization through marketing innovation*, International Conference on Innovation and Marketing, April 14-15, Venice, Italy
- 15 Maier A., Olaru M., Maier D., Marinescu M. (2013d), *Achieving performance of organization by developing a model of innovation management*, Proceedings of 8th European Conference on Innovation and Entrepreneurship, Sept 19-20 2013, Brussels, Belgium
- 16 Maier D, Maftai M, Keppler T, Maier A (2016a), *Study on the Organizational Resistance to Innovation*, Proceedings of 27th International Business Information Management Association Conference, Milan, Italy, May 04-05, 2016
- 17 Maier, D. Olaru, M., Weber, G., Maier A. (2014), *Business Success by Understanding the Process of Innovation*, Proceedings of the 9th European Conference on Innovation and Entrepreneurship (ECIE 2014), Location Belfast, Ireland, Pages: 534-538, Published 2014.
- 18 Maier D, Olaru M, Maier A, Eidenmuller T, (2016b), *Importance of Innovation in the Context of Changes Arising from Economic Globalization*, Proceedings of 27th International Business Information Management Association Conference, Milan, Italy, May 04-05
- 19 Maier D, Sven I, Sandru M, Maier A. (2017a), *Integrating innovation into business strategy in the context of a service-led economy*, BASIQ International conference: New Trends in Sustainable Business and Consumption, 31 mai – 3 Iunie, Graz, Austria
- 20 Maier D, Verjel, A, Bercovici A, Maier A, (2017b), *Innovation Management System - a Necessity for Business Performance*, Proceedings of 29th International-Business-Information-Management-Association Conference, Vienna, Austria, May 03-04, 2017
- 21 Maier D., Olaru M., Maier A. (2013), *Integrating concepts of innovation and creativity - a key to excellence in business*, Proceedings of 8th European Conference on Innovation and Entrepreneurship, Sept 19-20, 2013, Brussels, Belgium
- 22 Maier D., Olaru M., Maier A., Eidenmüller T. (2016c), *Importance of innovation in the context of changes arising from economic globalization*, Proceedings of 27th International Business Information Management Association (IBIMA) Conference, Milan, Italy, 4 – 5 May 2016
- 23 Maier D., Vadastreanu A.M., Keppler T., Eidenmüller T., Maier A. (2015a), *Innovation as a part of an existing integrated management system*, Proceedings of 4th World Conference on Business, Economics and Management–BEM 2015, April 30 – May 02, 2015, Kusasasi, Turkey
- 24 Maier, D, Anastasiu, L, Sarbu, R, Eidenmuller, T. (2015b), *Measuring the capacity of organizations innovation-major process of innovation management*, Amfiteatru Economic, Volume: 17 Pages: 1156-1166 Special Issue: 9
- 25 Maier, D, Maftai, M, Sven, JI, Golowko, N. (2016d), *Challenges regarding innovation management in the current global competition*, International Conference on Production Research - Regional Conference Africa, Europe and The Middle East (Icpr-Aem 2016) and 4th International Conference on Quality and Innovation in

- Engineering and Management (QIEM 2016), Joule 25-30, Cluj-Napoca, Romania
- 26 Maier, D., Sven-Joachim, I., Fortmuller, A., Maier, A. (2017a), *Development and operationalization of a model of innovation management system as part of an integrated quality-environment-safety system*, *Amfiteatru Economic*, 19(44),302-314
- 27 Maier, D, Sven-Joachim, I, Ceausu, R, Gavril, R, Maier A. (2017b), *Human Resource Management and Innovation Performance in Organizations*, Proceedings of 29th International-Business-Information-Management-Association Conference, Vienna, Austria, May 03-04, 2017
- 28 Maier, D. (2018a), *The Romanian national innovation performance in the EU context*, *International Journal of Advanced Engineering and Management Research*, Volume 3, Issue 6, <http://ijaemr.com/view2.php?issue=6>
- 29 Maier, D. (2018b), *Product and process innovation: a new perspective on the organizational development*, *International Journal of Advanced Engineering and Management Research*, Volume 3, Issue 6, <http://ijaemr.com/view2.php?issue=6>
- 30 Maier, D. (2018c), *Integration of management systems - key issues for the sustainable development of an organization*, *International Journal of Advanced Engineering and Management Research*, Volume 3, Issue 6, <http://ijaemr.com/view2.php?issue=6>
- 31 Maier, D. (2018d), *Study on the concerns of Romanian enterprises in the field of innovation in the context of implementing an integrated quality-environment-security management system*, *International Journal of Advanced Engineering and Management Research*, 3, 6, <http://ijaemr.com/view2.php?issue=6>
- 32 Maier, D. (2018e), *Quality and innovation as a source of sustainability in construction*, *International Journal of Advanced Engineering and Management Research*, Volume 3, Issue 6, <http://ijaemr.com/view2.php?issue=6>
- 33 Maier D., Maier A., Ceausu I., Gotesman E., Bercovici A. (2018f), *The role of human resource management in developing a culture of innovation in an organization*, 31th International Business Information Management Association, 25-26 April 2018
- 34 Maier D., Maier A., Murswieck R., Ionescu R. (2018g), *The beginning of innovation - simple methods and techniques for evaluating the innovative idea*, 31th International Business Information Management Association, 25-26 April 2018
- 35 Matias, H., C, Coelho, D., A. (2006), *Innovation in the Organisation of Management Systems as a Means of Survival and Growth of SMEs*
- 36 Mel, D., M. (2009), *Innovative firms or innovative owners? Determinants of innovation in micro, small and medium enterprises*, Policy Research Working Paper
- 37 Miller, M., L., Morris, L. (1999), *Fourth Generation R & D: Managing Knowledge, Technology and Innovation*, John Wiley & Sons, Inc., Canada
- 38 Nicoară D., Maier D., Maier A. (2013a), *Model of organizational processes developed within companies in order to innovate through technology transfer*, *International Journal of Economics, Finance and Management Sciences*, Vol. 1, Nr. 4, p. 196-204, SUA
- 39 Nicoară D, Maier A., Maier D. (2013b), *General aspects related to the technology transfer, the main source of innovation and development among economic operators*, *Annals of the „Constantin Brâncuși” University of Târgu Jiu, Economy Series*, Nr. 4, 2013
- 40 Niek D du Preez, L. (2006), *An Innovation Process Model for Improving Innovation Capability*, *Journal of High Technology Management Research*
- 41 Olaru M., Hohan A., Maier A., Maier D. (2013a), *Metrics for innovation of product – the basis for continuous improvement of an organization*, *Science Journal of Business and Management*, Vol. 1, nr 1, p. 26-30, SUA
- 42 Olaru M., Maier D., Maier A., Bodemann M., (2014)- *Integrated management systems, key factor for the sustainable development of an organization*, The 13th International Conference on Informatics in Economy, IE 2014, 15-18 May 2014, București, România
- 43 Olaru M., Maier D., Maier A., Nicoară D., (2013b) *Establishing the basis for the development of an organization by adopting the integrated management systems: comparative study of various models and concepts of integration*, 2nd World Conference on Business, Economics and Management–BEM 2013, April 25 – 28 2013, Antalya, Turkey
- 44 Popescu Maria (2016), *Managementul inovării*, Editura Universității Transilvania din Brașov, I S B N 9 7 8 - 6 0 6 - 1 9 - 0 7 5 9 – 5
- 45 Ribiere, V., Tuggle, F. (2010), *Fostering innovation with KM 2.0*, *The journal of information and knowledge management systems*, Vol. 40, Nr. 1, pp. 90-101
- 46 Roberts, E. (2007), *Managing Invention and Innovation*, In: *Research-Technology Management*, Vol. 50, Nr. 1, pp. 35-54
- 47 Rothwell, R. (1992), *Successful industrial innovation: critical factors for the 1990s*, *R & D Management*, vol. 22, nr. 3, pg. 221-39
- 48 Rothwell, R. (1994), *Towards the fifth-generation innovation process*, *International Marketing Review*, Vol.11, Nr. 1, pp. 7

- 49 Tidd, J. (1998), *Managing Innovation: Integrating Technological, Market and Organisational Change*, Wilney, London
- 50 Tidd, J., Bessant, J., Pavitt, K. (2001a), *Managing Innovation: Integrating Technological, Market and Organizational Change*, JohnWiley & Sons, Chichester
- 51 Tidd, J. (2001b), *Innovation Management in Context: Environment, Organization and Performance*, International Journal of Management Reviews, 3(3), 169-183
- 52 Tidd, J. (2006), *Innovation Models*, Science and Technology Policy Research Unit, Paper 1, Imperial College London
- 53 Vadastreanu A.M., Bot A., Dorin Maier, Andreea Maier (2015a), *The Need for Innovation Management in the Context of Integrated Management Systems*, ICEBR 2015: 17th International Conference on Economics and Business Research, Prague, Czech Republic July 9 - 10, 2015
- 54 Vadastreanu, A M., Maier, D., Maier A. (2015b), *Business success by improving the innovation management*, Proceedings of the 14th International Conference on Informatics in Economy International Conference on Informatics in Economy, Education, Research & Business Technologies, April 25 -28 2015, Bucharest, Romania
- 55 Vadastreanu A.M., Bot A., Maier D., Maier A. (2015c)– *Innovation the new challenge of today's entrepreneurship*, Science Journal of Business and Management, Science Publishing Group, New York, USA
- 56 Vachhrajani, H. (2008), *A symbiosis of Quality and Innovation : Creating an integrated model for SMEs*, QUALITY Striving for Excellence, National Centre for Quality Management, vol. 5, nr. 6.