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Analysis of quantitative empirical papers on diffusion and adoption of methods, techniques and tools for innovation

Pierry Teza, Gustavo Tomaz Buchele *, João Artur de Souza, Gertrudes Aparecida Dandolini

Universidade Federal de Santa Catarina – UFSC, Santa Catarina, Brasil

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Abstract

Effective use of methods, techniques and tools for innovation (MTT-I) has been considered an important factor for successful innovation management. However, studies related to the topic are still scarce, especially those using the quantitative empirical approach for research. Thereby, with the analysis of quantitative empirical papers related to diffusion and adoption of methods, techniques and tools for innovation, we intend to present a portrait of the empirical research on the topic. The analyzed papers were obtained through a systematic survey on two databases: Scopus and Web of Science. It resulted on a corpus of 18 publications, from which main papers, authors, countries and journals that most published about the theme and the most common keywords were identified. Later, the analysis of papers generated an overview of quantitative empirical research related to the topic and indicated areas for further study, contributing to the development of the subject. The study identified the scarcity of research related to the theme of diffusion and adoption of MTT-I and the concentration of quantitative empirical researches in product development, rather than in other results of innovation, such as services and processes. Methodological variations between studies were also identified, making it impossible to compare different contexts. This paper concludes displaying important points for further development of the field.

Keywords: Innovation; Methods; Tools and techniques for innovation; MTT-I; Systematic survey; Quantitative methods

Introduction

The study of innovation gained notoriety as from the 80s, since organizations realized that their ability to innovate strongly affects the future of the business. There are various points of view and concepts regarding innovation (Crossan & Apaydin, 2010). Baregheh, Rowley, and Sambrook (2009) argue that innovation is the multi-step process through which organizations transform ideas into products, services, or new/improved processes, in order to successfully progress, compete and differentiate themselves in the market.

Given its importance for organizations, several studies have focused on the innovation process, particularly looking at ways to improve it as a whole. These studies began with an increased focus on product development area (focusing on physical goods) and, over time, efforts have been transferred to the area of innovation, in order to cover other results of the process, such as new and/or improved services and processes. In general and simplified terms, the process of innovation consists of three parts – front end of innovation, development and implementation. The first part, the front end of innovation, corresponds to all activities performed until the decision making about an innovative concept and the beginning of its development, including for example the identification of opportunities and the generation of ideas; the second part, the development, corresponds to activities performed in order to specify and detail the concept as to make implementation possible, including for example prototyping, testing and project detailing; and finally the last part, the implementation, represents activities that "bring the concept to life", including production and market introduction, if applicable, since not every innovation is commercialized (Herstatt, Stockstrom, Verworn,

* Corresponding author.
E-mails: pierryteza@gmail.com (P. Teza), gustavotb.adm@gmail.com (G.T. Buchele).

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& Nagahira, 2006; Koen et al., 2001; Smith & Reinertsen, 1991).

The dimension covering important decisions to be taken in relation to the innovation process in general refers to which approaches (methods, techniques or tools) should be used in the process. These approaches support the understanding, analysis, decision and action throughout the innovation process (Phaal, Kerr, Oughton, & Probert, 2012). Among these approaches, here called methods, techniques and tools for innovation (MTT-I), are included brainstorming, morphological analysis, focus groups, concept testing, scenarios, return on investment (D'Alvano & Hidalgo, 2012; Nijssen & Lieshout, 1995). Other terms are used to refer to the MTT – tools (Coulon, Ernst, Lichtenthaler, & Vollmoeller, 2009; Hidalgo & Albors, 2008; Nijssen & Frambach, 2000); tools and techniques (Fleisher, 2006; Igartua, Garrigós, & Hervas-Oliver, 2010); methods (Lichtenthaler, 2005); models and methods (Nijssen & Lieshout, 1995). Analysis of the work related to the subject shows a confusion in the terminology (Phaal et al., 2012), since authors do not seek to explain the conceptual and operational differences, even when using two terms to name the approaches. Furthermore, few studies address the issue of terminology (e.g. Shehabuddeen, Probert, Phaal, & Platts, 1999). Here the terms methods, techniques and tools will be initially used without distinction between them, considering that they can be a document, framework, procedure, system or method that enables the organization to achieve or clarify a goal (Brady et al., 1997).

Effective use of MTT-I has been an important element in the management of the innovation process (Thia et al., 2005), since they facilitate the ability of an organization to appropriately introduce new technologies in products, processes and the necessary changes to the organization itself (Hidalgo & Albors, 2008). MTT-I can help them manage innovation, adapt to new circumstances and face the market challenges in a systematic way (Igartua et al., 2010). Chiesa and Masella (1996) stated in their audit model of the technological innovation process that the effective use of appropriate MTT-I is one of the three most important facilitators of the innovation process, together with the development of human and physical resources, leadership and support from top management. While they cannot guarantee success, the use of MTT-I may identify problems systematically, complementing the organization's efforts (Cooper & Kleinschmidt, 1986).

Therefore, two concepts are important in the study of MTT-I: diffusion and adoption. Adoption refers to the company's decision to use an MTT-I in their innovation process or reject its use, and diffusion refers to the cumulative number of companies that have adopted a particular MTT-I over time (Chai & Xin, 2006).

Exploratory surveys in the literature conducted by the authors of this study showed a predominance of works focusing on proposing and/or studying a MTT-I rather than studies focusing on the diffusion and adoption of MTT-I by organizations, which would focus on an amount of MTT-I. Thus, given the importance of methods, techniques and tools for the innovation process and the need of understanding how the empirical research have been approaching the diffusion and adoption of MTT-I, we established the following research question: how diffusion and adoption of methods, techniques and tools for innovation (MTT-I) have been empirically studied?

To answer the research question, a systematic survey was performed in two scientific databases, followed by categorization of collected works and analysis of those whose empirical studies have focused on the diffusion and adoption of MTT-I. This paper discusses the results of the analysis of quantitative empirical papers, considering that, by representing larger samples and often testing hypotheses, quantitative papers bring stronger conclusions to the field and are more appropriate to answer the research question. However, qualitative papers collected in this research were used additively, in order to substantiate the analysis here exposed.

In second section, this paper presents the methodological procedures to the study; in third section, the results of the analysis of quantitative empirical papers; in fourth section, the final considerations and proposals for future research; and finally the literature references.

Methodological procedures

Results were obtained from two distinct phases: (a) survey of papers related to MTT-I; (b) analysis of quantitative empirical papers related to MTT-I. In the first phase, in addition to the survey of papers, we made a bibliometric overview of research in this area as well as the identification of quantitative empirical papers central to this study. This phase was performed through the steps proposed by Botelho, Cunha, and Macedo (2011). The authors divide the process of an integrative review in six steps:

Step 1. **Identification of theme and selection of the research question**: From the aim of the research and the proposed research question, it is necessary to define the keywords that will be used in the search. Accordingly, the search was conducted in January 2014 in Scopus and Web of Science databases to the following terms combined with the term *innovation*: *method*; *technique*; *tool*. The search observed titles, abstracts and keywords. Tens of thousands of papers were found, which could make the analysis impracticable. Also, we found out that in some cases, MTT-I are discussed in such fields as development of new products and technological intelligence, and these terms are mentioned in the papers' titles without the term "innovation". Thus, in order to facilitate the analysis we decided to conduct the search only in the titles of papers. So that relevant papers were not lost, it was decided to expand the keywords search. Thereby, the terms *front end*; *innovation*; *product development*; *technology development*; *technology intelligence*; *technology management* were selected to search in the databases, individually combined with the terms method, technique and tool.

Step 2. **Establishment of inclusion and exclusion criteria**: Through an in-depth analysis, the papers were classified