Literature Review of the Measurement in the Innovation Management

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Abstract: Organizations create innovation strategies to improve their productivity and the competitive advantage. In this sense, innovation management facilitates the realization of innovation. It is known that measurement is important in the management processes; however, there is no classification of the contributions in these subjects. Therefore, in this study we identify publications that involve measurement and analysis in the management of innovation. Our study used a systematic mapping of the literature and it shows that in recent years there has been an increase in research on measurement, however, there are few studies and only for certain industrial sectors, sizes of companies and countries. Hence, there is a little worked research space which can be more developed.

Keywords: Innovation management; measurement of innovation management; innovation, measurement; management; metrics, impact; systematic mapping; mapping; review.

Introduction

The business environment is dynamic, accordingly organizations try to improve their performance and become more and more competitive (Taghizadeh, Jayaraman, Ismail, & Rahman, 2014). In this context, innovation, as a way to obtain a new or significantly improved product (goods or services) (OECD, 2005), is a promoter of economic growth, competitiveness and prosperity of organizations (Sillanpää & Junnonen, 2012). Some authors mention that innovations provide a competitive advantage to companies ((Taghizadeh et al., 2014); (Dereli, 2015); (Hervas & Dalmau, 2006)).

The innovation management is a mechanism that allows the innovation process to be formalized, facilitating companies to generate new ideas, practices and products in a systematic way (Pinheiro & Tigre, 2015), producing a positive effect of innovation in the performance of small, medium and large companies (Ndubisi, Capel, & Ndubisi, 2015).

Therefore, innovation management is strategic for the survival of organizations (Ortt & Van der Duin, 2008). The management of innovation processes involve activities, tools (Bajenescu, 2017) and in general, respond to a structure that relates resources, skills, knowledge, technology, management and business (Murcia Rivera, 2012).

If a company intends to be successful in achieving competitive advantage by developing innovation, it must have an effective implementation of innovation management, for which it needs to define strategies and build an administrative structure to support its innovations (Dereli, 2015). The companies can be successful or not when applying their strategies, so it is important to define procedures to measure and analyze the innovation management and identify the improvements needed to contribute to achieving the desired performance (Taghizadeh et al., 2014). However, although some related studies on innovation management are known, some authors agree that there is little research on this topic ((Mir, Casadesús, & Petnji, 2016); (Taghizadeh

et al., 2014)). Following the affirmation of the authors, the present research has as hypothesis the existence of a small population of studies on the measurement of innovation management.

The objective of this study is to determine the contributions that researchers have made on the measurement of innovation management in the organizations. For which, an analysis has been carried out using the technique of systematic mapping. Section 2 addresses the systematic mapping process carried out. Section 3 describes the results obtained by answering the research questions. Section 4 presents the conclusions and future work.

Design and execution of the research

The study was carried out using the methodology of literature systematic mapping of the Petersen (Petersen, Feldt, Mujtaba, & Mattsson, 2008) and relevant aspects of the methodology of literature systematic review proposed by Kitchenham (Kitchenham et al., 2009). In this section, the research questions, the collection procedure, selection of studies, data extraction and classification of the studies are described

Definition of the research question

To achieve the objective of the study, it was defined three research questions (RQ): RQ 1: How have publications on innovation management measurement evolved? This question is to determine how the number of publications related to the measurement of innovation management has varied and what types of research have been used for these studies. RQ 2: What is the contribution of the set of publications in relation to the measurement of innovation management? It is expected to find some model, framework, methodology or analysis that refers to some form of measurement of innovation management. RQ 3: What kind of industrial sectors and sizes of companies are involved in the set of publications? The objective is to identify the industrial sectors and the size of the companies with the most research done.

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Collection of studies

The elaboration of the search string followed the PICO strategy (Population, Intervention, Comparison, Results) presented by Santos (Santos, Pimenta, & Nobre, 2007). To achieve a greater breadth of search, we decided to consider two elements of the PICO: (1) Population: set of elements that are subject to revision, for the mapping, the keyword used was "innovation management"; (2) Results: information that is expected from the research, for the mapping, it is all information that involves a measurement exercise, therefore, the keywords considered were: ("measurement" OR "value" OR "measure" OR "impact" OR "metrics").

The search string obtained was ("innovation management") AND ("measurement" OR "value" OR "measure" OR "impact" OR "metrics"), and it was executed in the libraries: EbscoHost, Emerald, Proquest, IEEExplore, ScienceDirect, and WebOfScience.

Selection of studies

The selection of the primary studies was carried out following a three-stage process. In the stages, inclusion criteria (IC), exclusion (EC) and validation of the studies were applied.

In the first stage, the exclusion criteria (EC) were defined and applied in the following order: (EC1): studies published in journals indexed or presented at research conferences; (EC2): studies published from 2007 onwards, considering that the UNE 166002 is a certifiable standard and its first edition was published in 2006 (CTN 166 - Actividades de investigación, 2014); (EC3): studies that are in languages other than English, Portuguese or Spanish; and (EC4): duplicate studies.

The second stage carried out applying inclusion criteria (IC) in the following order: (IC1): studies whose titles and keywords are related to research questions are accepted; and (IC2): studies are included whose summaries; introduction or conclusions are related to the objective of the present study.

The third stage consisted of the validation of the primary studies to answer the research questions. The quality assessment criteria (QAC) were applied in the following order: (QAC1): does the study describe topics related to research questions?; (QAC2): do the findings described in the study help answer the research questions?; (QAC3): does the study contain a clear statement of the objectives of the research?; (QAC4): does the study use an adequate research methodology?; (QAC5): do the conclusions address the objectives of the research?; (QAC6): was the study subjected to a rigorous review process?

According to the authors (Kitchenham, Mendes, & Travassos, 2007) and (Sulayman & Mendes, 2009) recommend assigning scores in the evaluation of QAC: equal to 1, if the article meets the criteria, equal to 0.5, if the article partially complies, equal to 0, if the study does not meet the criteria. The articles had a total score greater than three, consequently, all the studies obtained from the second stage were considered as primary for the present research.

The execution of the search string returned 2080 studies. In the execution of the first stage 1072 studies were obtained, and in the second stage, 17 primary studies were achieved. The studies obtained scores higher than three in the quality assessment, so they were ratified at the end of the third stage.

Extraction, classification and initial results

The relevant data of each primary study were recorded in a form and then classified. The types of data extracted were: the year, the size of the company, the industrial sector, and the country (see Table 1). These types of data allowed to make some classifications and consolidate the results for a better analysis.

Some studies mentioned having done their research in company sizes such as: small and medium enterprises (SME), small, medium and large companies, but there were other studies that did not specify the size (Table 1). The industrial sectors found have been very varied, so we prefer not to make any classification and present them directly in Table 1. In the case of countries, it was also very varied; however, if we classify them based on continents, we observe that the theme developed is not alien to the interests in research and development. The countries of the primary studies of Table 1 belong to the group of countries that stand out in research and development in each continent according to the world bank (UNESCO, 2018).

Answer of the research questions

In this section, we present the answers to the RQ based on an analysis from the data extracted from the primary studies.

RQ 1: How the publications on measurement of innovation management have evolved?

If we look at Table 1 we see that there is a lot of research related to innovation management, however, on the subject related to the measurement only 17 articles were found. A striking fact is that the largest number of articles were submitted between 2014 and 2017, coinciding with the appearance of the second version of the UNE 166002 standard (CTN 166 - Actividades de investigación, 2014), which could explain the increase in the number of articles.

It is important to mention that the first non-experimental version of the UNE 166002 standard on requirements for a management system for research, development and innovation (R+D+i) was published in 2006 (CTN 166 - Actividades de investigación, 2014).

Table 1. Principal information of primary articles.

Reference	Company size	Industrial sector	Country
(Wong & Chin, 2007)	Not precise	Manufacture	Hong Kong
(Tien, Chiu, Chung, & Tsai, 2007)	Not precise	High technology	China
(Arzola & Mejías, 2007)	Not precise	Services	Not precise
(Singh & Markeset, 2008)	Not precise	Gas and oil	Norway
(Salazar, Arzola, Pérez, Gerencia, & Zulia, 2010)	Small and medium	No precise sector	Venezuela
(Sánchez, Lago, Ferràs, & Ribera, 2011)	Not precise	High technology electronics	Spain, Portugal
(Cohn, 2013)	Small, medium and large	Not precise	Canada
(Taghizadeh et al., 2014)	Not precise	Telecommunications	Malaysia
(Moreira & Stramar, 2015)	Not precise	Information technology	Brazil
(Ošenieks & Babauska, 2014)	Small and medium	Not precise	Latvia
(Vitezić & Vitezić, 2014)	Not precise	Industrial, Services, Commerce, Financial	Croatia
(Song, Ming, Han, Xu, & Wu, 2015)	Not precise	Manufacture	Not precise
(Rahman, Taghizadeh, Ramayah, & Ahmad, 2015)	Not precise	Telecommunications	Malaysia, Bangladesh
(Dickel & Moura, 2016)	Not precise	Metalworking	Brazil
(Mir et al., 2016)	Small, medium and large	Not precise	Spain
(Alfaro-García, Gil-Lafuente, & Alfaro Calderón, 2017)	Small and medium	Manufacture	Mexico
(Danilevicz & Correa, 2017)	Not precise	Electrical energy	Brazil

The UNE 166002 standard allows the implementation of a system of R+D+i management for organizations, which may opt for a certification granted by AENOR (CTN 166 - Actividades de investigación, 2014). Being a certifiable standard, this implies carrying out measurement activities, and therefore a reason of interest in researchers to address topics of innovation management measurement.

RQ 2: What is the contribution of the publications in relation to the measurement of innovation management?

The proposals found have been named according to the authors as a model, framework, system, methodology and as an analysis research. In general, the studies have developed the theme of innovation management where they included, in one of their tasks, some measurement activity as it is summarized below:

(Arzola & Mejías, 2007): define the 7D conceptual model oriented to the evaluation of internal management in service organizations, measures performance with the objective of exceeding customer expectations. It is based on the criteria of excellence models of management and measurement of innovation, defining seven dimensions and quantitative and qualitative criteria for each. The dimensions are leadership, strategic planning, customer satisfaction, processes, organization, human resource competencies and social responsibility.

(Tien et al., 2007): propose a theoretical model that analyzes the impact of the implementation of innovation management in high-tech manufacturing companies in Taiwan. It works with mediating variables, such as type of industry and company level, to demonstrate a significant impact on competitiveness.

(Salazar et al., 2010): define a model for the management of innovation in SMEs, allows organizing and systematizing processes, projects

and R+D+i resources. It describes five aspects: management responsibility, resource management, processes, R+D+i activities, measurement, analysis and improvement.

(Sánchez et al., 2011): define a conceptual model that evaluates the innovative behavior of the company based on the practices that performs on innovation management. It allows to know how innovation management is related to the growth and performance of companies in the medium and long term. The model consists of nine dimensions and 19 factors that characterize the organizational behavior. According to the authors, depending of the industrial environment and company type, different innovation management practices are used.

(Moreira & Stramar, 2015): propose a holistic model of innovation management from a social approach. It consists of seven basic values for the analysis and understanding of innovation management: strategy, learning, knowledge, confidence, creativity, power, culture.

(Vitezić & Vitezić, 2014): define a conceptual model of sustainable innovation, propose a constant measurement of innovation. It is based on controllers that define metrics and tools for analyzing the effectiveness of innovation. The controllers accompany the innovation process in general and propose adjustments.

(Dickel & Moura, 2016): propose a model that measures the performance of the organization based on measurement criteria for two factors: knowledge management and innovation management. In knowledge management, it measures the ability to use the experiences of people, the infrastructure and processes of the organization around knowledge. Innovation management assesses the ability of the organization to focus on innovation development.

(Mir et al., 2016): define a model that is an adaptation of the proposals of (Lawson & Samson, 2001) and (Saunila & Ukko, 2012). The first proposal considers three dimensions: standardized innovation management system, innovation capacity and business performance. The second proposal establishes a framework for measuring innovation capacity. The model defines as SIMSMA2 (Standardized Innovation Management System Model Analysis) uses six dimensions: the innovation performance, the innovation capacity, business performance, managing innovation through the UNE 166002, financial crisis, and types of innovation.

The contributions that the authors present as frameworks:

(Wong & Chin, 2007): describe a hierarchical framework for the organizational innovation management (OIM) in the manufacturing industry. The authors define three categories, which are divided into seven focus areas, each area defining a group of critical factors to evaluate OIM best practices.

(Singh & Markeset, 2008): define a framework for the management and coordination of service innovation in the oil and gas industry. Develops the service innovation processes in four phases: idea collection, evaluation of ideas, development of service design, and implementation, the latter includes service review and improvements for delivery.

(Cohn, 2013): defines a management framework for corporate value-added innovation. The framework has five levels and develops a tool for assessing competitiveness based on questions. The objective is to analyze the company and progress with respect to its competitors, obtaining aspects to innovate, determine strengths and weaknesses to achieve its goals.

(Song et al., 2015): propose a systematic framework for the innovation management of PSS (product–service system). It consists of three levels: strategic, tactical and innovation support. The support level defines the performance management to be able to evaluate and provide feedback to the other levels to improve the future operation. The contributions that the authors present as a system, methodology and analysis research:

(Taghizadeh et al., 2014): realize an analysis of the SPOTS model (strategy, process, organization, tools/technology, system) for the telecommunications industry. The model is used to explain how service innovation practices influence market performance, the service development and the delivery process performance. The model defines an innovation process with a control process to help reduce time and cost in the development of new products.

(Ošenieks & Babauska, 2014): present an analysis of SMEs in Latvia. The analysis uses success critical factors as the measurement system

performance that involves: growth, stability, profit and market share. Other factors consider the application of knowledge in innovation: competitive advantage through knowledge and collaboration practices, knowledge as a resource to reduce complexity in the innovation process, availability of internal and external knowledge.

(Rahman et al., 2015): realize a study on non-financial performance measurement through two models: measurement model and the structured model. The study focused on the activities of measuring the new services development and the delivery process improvement. Conducted a survey to evaluate establishment of standards for the performance of services, mapping processes to reduce activities without value, improvement documentation of process, measurement compliance with the processes, institutionalization of continuous improvement processes.

(Alfaro-García et al., 2017): define a methodology of measurement of innovation management based on the seven key areas of innovation measurement proposed by (Adams, Bessant, & Phelps, 2006). It consists of a survey made to small and medium manufacturing companies and an analysis of subjective information. The analysis uses two techniques: (1) the theory of expertons for the review of all opinions, (2) the induced generalized ordered weighted aggregation operator, which complements the result of the first technique.

(Danilevicz & Correa, 2017): define an innovation management system (IMS) to guide the decision-making process in the selection of potential projects. In addition, propose indicators to monitor the selected projects. It consists of three pillars: stimulation towards innovation, selection of ideas, and implementation of projects.

RQ 3: What kind of sectors of the industries and size of companies are involved in the publications found?

The industrial sectors and the sizes of the companies declared in the primary studies were reviewed, finding that the largest population of studies occurs in the manufacturing sector (17.6%), services (11.8%) and telecommunications (11.8%), although a 29.4% of the studies did not specify a sector (Table 1).

Likewise, from Table 1 and Figure 1 we can mention that: (i) 70.6% of the studies do not specify the size of the companies involved, (ii) 17.6% of the studies were conducted in small and medium-sized companies, where one of them was from the manufacturing sector, other two studies that did not specify the sector, (iii) for the small, medium and large company, 9.1% were presented but no sector was required, (iv) 70.6% of the studies did not define company size, however some of them do not specify the sector.

Figure 1. Primary studies according to year and size of company
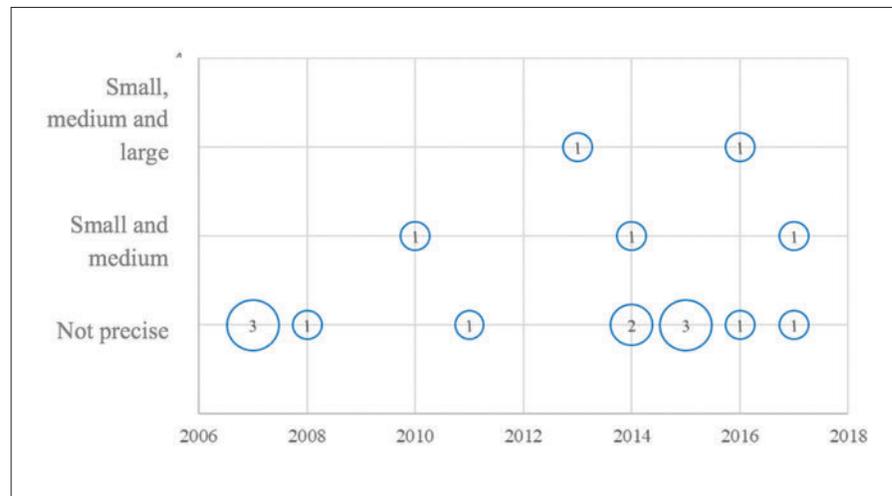
The Figure 1 corroborates the statement that, in recent years, there has been a greater interest in the issue of measurement of innovation management. Therefore, we find more bubbles from 2014 onwards.

Conclusions and future work

The main objective of our study was to determine the contributions that researchers have made on the measurement of innovation management. In RQ1, it has been possible to find an increase in the number of publications on the measurement of innovation management, which suggests an interest in the subject. From RQ2 these publications are very specific to the need and context in which they were developed, and according to RQ3 this occurs in the manufacturing sector.

Based on the findings found, it can be concluded that there are few studies on the measurement of innovation management, even though interest in various countries in the world is notorious. There has been an increase in publications in recent years and a variety on the subject in research. While there are some contributions on measurement, these are not for all sectors or sizes of company. The contributions found on the measurement of innovation management were developed in a context related to issues such as performance, effectiveness, competitiveness, improvement, among others, and specific to a sector and company size.

As future works, there are several knowledge areas to be developed yet, either to create a model, a methodology or a framework for establishing ways of measuring innovation management. In addition, cases of application of existing contributions can be made, but in contexts that complement or improve the results obtained.

References

Adams, R., Bessant, J., & Phelps, R. (2006). Innovation management measurement: A review. *International Journal of Management Reviews, 8*(1), 21–47. https://doi.org/10.1111/j.1468-2370.2006.00119.x

Alfaro-García, V. G., Gil-Lafuente, A. M., & Alfaro Calderón, G. G. (2017). A fuzzy methodology for innovation management measurement. *Kybernetes*, *46*(1), 50–66. https://doi.org/10.1108/K-06-2016-0153

Arzola, M., & Mejías, A. (2007). A conceptual model for innovative management in service sector companies. Revista Venezonala de Gerencia, 12(37), 80–98. Retrieved from http://www.redalyc.org/articulo.oa?id=29003706

Bajenescu, T. (2017). The business value of innovation management. *FAIMA Business & Management Journal, 5*(2), 40–51. Retrieved from https://search.proquest.com/openview/85342296e757e501303a360e6acb5314/1.pdf?pq-origsite=gscholar&cbl=2037693

Cohn, S. (2013). A Firm-Level Innovation Management Framework and Assessment Tool for Increasing Competitiveness. *Technology Innovation Management Review*, *3*(10), 6–15. https://doi.org/10.22215/timreview731

CTN 166 - Actividades de investigación, desarrollo tecnológico e innovación (I+D+i). (2014). UNE 166002:2014. Retrieved May 24, 2018, from https://www.aenor.es/aenor/normas/normas/fichanorma.asp?tipo=N&codigo=N0052892&PDF=Si#.WwduXEgvzIU

Danilevicz, A. M. F., & Correa, C. H. (2017). Innovation management system based on performance drivers: a study applied to the Brazilian electric power sector. *In Proceedings of the 2017 Industrial and Systems Engineering Conference* (pp. 1894–1900). Retrieved from https://search-proquest-com.ezproxybib.pucp.edu.pe/docview/1951118259?accountid=28391

Dereli, D. D. (2015). Innovation Management in Global Competition and Competitive Advantage. *Procedia - Social and Behavioral Sciences, 195*, 1365–1370. https://doi.org/10.1016/j.sbspro.2015.06.323

Dickel, D. G., & Moura, G. L. de. (2016). Organizational performance evaluation in intangible criteria: a model based on knowledge management and innovation management. *RAI Revista de Administração e Inovação*, *13*(3), 211–220. https://doi.org/10.1016/j.rai.2016.06.005

Hervas, J., & Dalmau, J. (2006). How to measure IC in clusters: empirical evidence. *Journal of Intellectual Capital*, *7*(3), 354–380. https://doi.org/10.1108/14691930610681456

Kitchenham, B., Mendes, E., & Travassos, G. H. (2007). A systematic review of cross-vs. within-company cost estimation studies. *IEEE Transactions on Software Engineering*, *33*(5), 316–329. https://doi.org/10.1109/TSE.2007.1001

Kitchenham, B., Pearl Brereton, O., Budgen, D., Turner, M., Bailey, J., & Linkman, S. (2009). Systematic literature reviews in software engineering - A systematic literature review. *Information and Software Technology*, *51*(1), 7–15. https://doi.org/10.1016/j.infsof.2008.09.009

Lawson, B., & Samson, D. (2001). Developing innovation capability in organisations: a dynamic capabilities approach. *International Journal of Innovation Management*, *05*(03), 377–400. https://doi.org/10.1142/S1363919601000427

Mir, M., Casadesús, M., & Petnji, L. H. (2016). The impact of standardized innovation management systems on innovation capability and business performance: An empirical study. *Journal of Engineering and Technology Management*, *41*(June), 26–44. https://doi.org/10.1016/j.jengtecman.2016.06.002

Moreira, É. T., & Stramar, A. R. (2015). Modelo holístico da gestão da inovação com ênfase na cooperação, flexibilidade e adaptação. *Review of Administration and Innovation - RAI*, *11*(4), 193. https://doi.org/10.11606/rai.v11i4.100279

Murcia Rivera, C. (2012). *Modelo de análisis para la evaluación de la innovación: Un enfoque multidimensional e interdisciplinar*. Universidad Autónoma de Madrid. Retrieved from https://repositorio.uam.es/xmlui/handle/10486/13793

Ndubisi, N. O., Capel, C. M., & Ndubisi, G. C. (2015). Innovation strategy and performance of international technology services ventures. *Journal of Service Management*, *26*(4), 548–564. https://doi.org/10.1108/JOSM-04-2015-0118

OECD. (2005). *Manual de Oslo - Guía para la recogida e interpretación de datos sobre innovación* (3th ed.). Organización para la Cooperación y el Desarrollo Económicos (OCDE), Oficina de Estadística de las Comunidades Europeas. Retrieved from http://www.itq.edu.mx/convocatorias/manualdeoslo.pdf

Ortt, J. R., & Van der Duin, P. A. (2008). The evolution of innovation management towards contextual innovation. *European Journal of Innovation Management*, *11*(4), 522–538. https://doi.org/10.1108/14601060810911147

Ošenieks, J., & Babauska, S. (2014). The relevance of innovation management as prerequisite for durable existence of small and medium enterprises. *Procedia - Social and Behavioral Sciences*, *110*, 82–92. https://doi.org/10.1016/j.sbspro.2013.12.850

Petersen, K., Feldt, R., Mujtaba, S., & Mattsson, M. (2008). Systematic mapping studies in software engineering. *12nd International Conference on Evaluation and Assessment in Software Engineering (EASE' 08)*, 1--10. Retrieved from https://dl.acm.org/citation.cfm?id=2227115.2227123

Pinheiro, A., & Tigre, P. (2015). Proposta de investigação sobre o uso de software no suporte à inovação em serviços. *Revista de Administração de Empresas*, *55*(5), 578–592. https://doi.org/10.1590/S0034-759020150509

Rahman, S. A., Taghizadeh, S. K., Ramayah, T., & Ahmad, N. H. (2015). Service innovation management practices in the telecommunications industry: what does cross country analysis reveal? *SpringerPlus*, *4*(1), 810. https://doi.org/10.1186/s40064-015-1580-8

Salazar, M., Arzola, M., Pérez, E., Gerencia, R. V. De, & Zulia, U. (2010). Gestión de la innovación para las Pymis de ciudad Guayana. *Revista Venezolana de Gerencia (RVG)*, *15*(51), 446–461. Retrieved from http://www.redalyc.org/articulo.oa?id=29016318006

Sánchez, A., Lago, A., Ferràs, X., & Ribera, J. (2011). Innovation Management Practices, Strategic Adaptation, and Business Results: Evidence from the Electronics Industry. *Journal of Technology Management & Innovation*, *6*(2), 14–39. https://doi.org/10.4067/S0718-27242011000200002

Santos, C. M. D. C., Pimenta, C. A. D. M., & Nobre, M. R. C. (2007). The PICO strategy for the research question construction and evidence search. *Rev Latino-Am Enfermagem*, *15*(3), 2–5. https://doi.org/10.1590/S0104-11692007000300023

Saunila, M., & Ukko, J. (2012). A conceptual framework for the measurement of innovation capability and its effects. *Baltic Journal of Management*, *7*(4), 355–375. https://doi.org/10.1108/17465261211272139

Sillanpää, E., & Junnonen, J. (2012). Factors affecting service innovations in FM service sector. *Facilities*, *30*(11/12), 517–530. https://doi.org/10.1108/02632771211252342

Singh, S., & Markeset, T. (2008). Development of a framework for industrial service innovation management and coordination. *Journal of Quality in Maintenance Engineering*, *14*(2), 177–193. https://doi.org/10.1108/13552510810877674

Song, W., Ming, X., Han, Y., Xu, Z., & Wu, Z. (2015). An integrative framework for innovation management of product–service system. *International Journal of Production Research*, *53*(8), 2252–2268. https://doi.org/10.1080/00207543.2014.932929

Sulayman, M., & Mendes, E. (2009). A systematic literature review of software process improvement in small and medium web companies. *In International Conference on Advanced Software Engineering and Its Applications* (pp. 1–8). https://doi.org/10.1007/978-3-642-10619-4_1

Taghizadeh, S. K., Jayaraman, K., Ismail, I., & Rahman, S. A. (2014). A study of service innovation management in the Malaysian Telecommunications Industry. *Global Business and Organizational Excellence*, *34*(1), 67–77. https://doi.org/10.1002/joe.21585

Tien, S. W., Chiu, C. C., Chung, Y. C., & Tsai, C. H. (2007). The impact of innovation management implementation on enterprise competitiveness among Taiwan's high-tech manufacturers. *International Journal of Technology Management*, *40*(1/2/3), 7. https://doi.org/10.1504/IJTM.2007.013525

UNESCO. (2018). *Investigadores dedicados a investigación y desarrollo. Instituto de Estadística de la Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura*. Retrieved from https://datos.bancomundial.org/indicador/SP.POP.SCIE.RD.P6?end=2015&start=1996&view=chart

Vitezić, N., & Vitezić, V. (2014). A conceptual model of linkage between innovation management and controlling in the sustainable environment. *Journal of Applied Business Research (JABR)*, *31*(1), 175. https://doi.org/10.19030/jabr.v31i1.8999

Wong, S.-Y., & Chin, K.-S. (2007). Organizational innovation management: An organization-wide perspective. *Industrial Management & Data Systems*, *107*(9), 1290–1315. https://doi.org/10.1108/02635570710833974