Organizational Maturity Models: Trends for the Future

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Abstract By adopting a maturity model (MM) an organization aims ascending to a higher maturity level and, simultaneously, preserve the evolution attained thus, for this reason, is mandatory to prospect the trends for future. This article intends to address the organizational maturity concept, evolution shift perspectives and establish the current landscape by performing a bibliometric analysis aiming to detect trends and evidences of convergence. The purpose is the identification of opportunities for further study and to deepen the theoretical-scientific universe of the subject. Throughout a scrutiny of diverse data nucleus (databases), this paper supports the theory that there is increased interest from the academic community (including the occupational health and safety academic community) and entrepreneurial market on organizational maturity models (OMM's) adoption. The pivotal fields are outlined in order to fulfill scholars, practitioners and managers' information needs and expectations, as well the research behavior, which can booster forward-looking insights. Inasmuch, is stressed the urge for development of the safety management and related maturity as a research topic.

Keywords Bibliometric analysis · Industry 4.0 · Management · Maturity · Maturity model · Safety management

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1 Introduction

The business horizon enforces organizations to challenge their strategy and soar from their current position to an excellence level. Considering the global market dynamics and insurgent products requirements, not just technical but including environmental and occupational health and safety (OHS) issues [1], the companies must foster technology, and innovation to distinguish themselves. By setting quality parameters and establishing controls to satisfy beyond technical specifications (also the requirements of the most demanding customers) creates opportunity: a *continuum* of pursuing Quality and the achievement of organizational maturity. Furthermore it is necessary to extrapolate the parameters and to reach more than solely adaptation to the entrepreneur environment, it is necessary create value for customers and Society. Thus, it is essential to plan the organizations' future and embodying innovation perspectives into the organizational mindset. The organizational ripening must occur through and integrated approach and holistically, which captures the complexities of externalities and organizational reality. Albeit the multitude of MM's existing in literature that envisages those parameters it also constitutes a difficulty among the practitioners to select the more operating one for the organizational strategy and objectives [9]. Top management sense concerning the interrelationship of this range of factors is a fence against uncertainty.

The maturity level reflects the actual capability in terms of management. As an organization evolves to safety is assigned a high priority and to turn it into efficient reality must be carry out the harmonization of safety practices through adoption of a common 'language' [2]. The hallmarks of an immature organization are reactivity and improvisation in which the decision to implement improvements is triggered only by emergencies. Those sort of organizations usually display extent chaotic processes with no regulatory requirements. In order to the occurrence of awareness (where the organization evolves from an immature stage to one that seeks to start maturation) must exist proactivity for learning, exploitation of mistakes like lessons learned and improvement opportunities, and also, accept the active participation and enrolment of the whole staff. The cultural shift, thus, must come from top management and should diffuse throughout all organizational levels. It is imperative to point out that evolution happens optimally with commitment. It is top management assignment the dissolution of behavioral and cultural barriers [7], and transmits the goals' significance so employees can understand the relevance of changes either perceive their role in the endeavor.

Hence, this article aims to address the organizational maturity concept and establish the current landscape of the extant literature on the subject OMM's. Therefore the main objectives are: (i) to perform a bibliometric analysis adopting a visual mapping tool to pinpoint correlations and detecting research streams, which includes the identification of trends and evidences of research convergence to new topics (ii) put in classification criterial for models as appropriate its implementation field; (iii) to identify the topics in which opportunities emerge for further study and deepening, which means inferring whether the scientific community provides content in parallel with the scholars, practitioners and managers' needs.

2 Methodological Background

2.1 Bibliometric Analysis

The bibliometric concept encompasses the act of identifying the current prospect of the theoretical-scientific universe of a targeted subject using quantitative methods; hence, it reflects the content behavior and its research structure on present. It is an effective technique for studying in an intellectual field and examining how it evolves [10]. Bibliometric analysis is a useful tool for finding patterns, which provides insights and disruptions. According to Kilubi [5], "an increasing number of academic researchers have dedicated their attention to bibliometric studies to evaluate the advance of management disciplines evolving from their juvenile stages". This paper adopts bibliometric analysis methods aiming at the visual mapping of the extant literature on OMM's by extracting the modal terms. It is intended to establish the terms linkages and to measure the contents' strength being the outcome "gauging the state-of-the-art of its discipline and to frame future requirements and research prospects" [5]. The first step encompasses the development of a network diagram. Thereafter, the second step covers the statistical analysis and discussion of results. The selected publications were identified from the Scopus database by adopting the keywords 'organizational maturity model'. Restrictive filters were applied in order to diminish the publications set to a manageable amount, enabling further individual analysis of the abstracts. The resulting final sample comprised 242 publications embedded in the time horizon from 2004 to 2019.

2.2 Visual Mapping: A Network Diagram

Narrowed the database follows the visual mapping stage of the modal terms at the scope of scientific research. The shape is a theme network that illustrates the intellectual arrangement of the subject (using the abstracts' content) which, inherently, it is a static view and has an ad hoc nature (i.e. provisional). The ensuing appraisal is diametrically opposed: approaches the evolution of research in a *continuum* whereby the production of scientific content undergoes critical revisions continuously.

The software VOSviewer [8] was adopted to develop the network diagram encompassing a body of analysis of 242 abstracts. The diagram points out the recurrent words, where each of these terms has distinct weight and is represented by their label and, by default, also by a circle. Terms with a higher weight are shown more prominently size variation: the higher the weight of an item, the larger the label and the circle of the item [8]. The network visualization also points out the intertwined nature between the terms so the number of links is an attribute of the concepts correlation. The outcome is the demonstration of the strong keywords

correlation, which are 'industry', 'technology', 'project', 'organization', 'culture' and 'improvement', amidst others, widely used in the context of OMM's scientific research within the 2004–2019 time range Fig. 1. It is reasonable to consider if publications and their references reflect the shared research interests and work contents, then bibliometric methods provide a useful approximation to the social environment behind the citation maps [10]. The identified keywords and their connections bring to light topics not solely pertaining to the MMs' context but also other keywords encompassing the surrounding environment in the macroeconomics, technological, business management and externalities that drive the research. The connections traced are a prospect that underpins future academic endeavors.

2.3 *Data Analyses*

Starting by the etymological concept of statistics that includes data collection and classification, statistical analyses are performed in order to develop classification and clustering criterial for OMM's as appropriate its implementation field. Exploiting the set of 242 abstracts follows the distribution chart Fig. 2 of the total publications. It shows a growth of the number of publications year by year (as highlighted by the trend line) where the peak occurs in 2014.

On a different note, a hypothesis is a conjecture about an unknown event, a condition that can properly explain something that is presumed empirically. It is legitimate to accept that the data Fig. 2, in parallel with number of publications

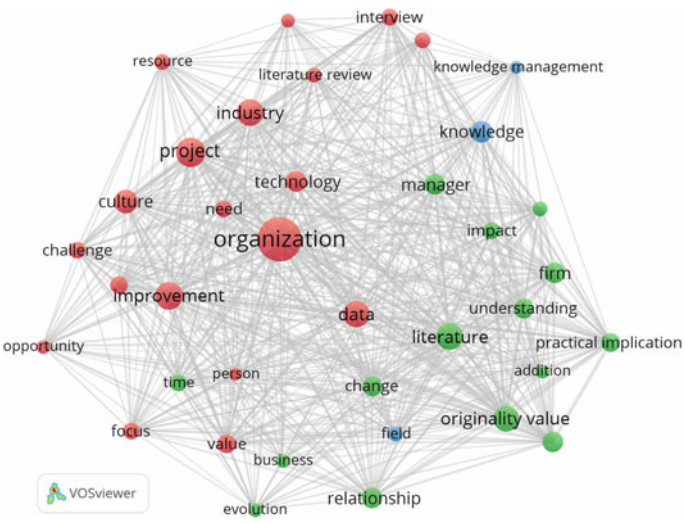

Fig. 1 The network diagram illustration of the sample: an intellectual arrangement

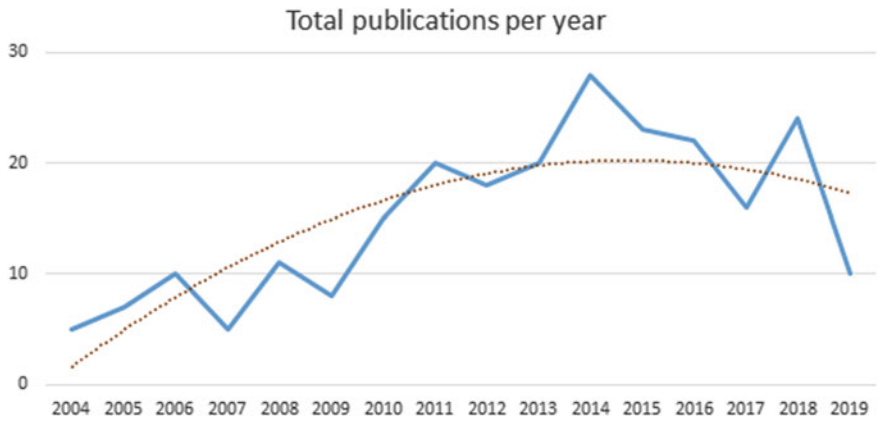

Fig. 2 Total number of publications—breakdown by year

Table 1 Most cited papers under organizational maturity models sample [3]

Author	Publication year	Scope	Citations
Schumacher, A., Erol, S., Sihn, W.	2016	Industry 4.0 advent	119
Grant and Pennypacker	2006	Project management	116
Khosrowshahi and Arayici	2012	Information technology	109

growth, support the assumption that there is an increased interest from the academic community and entrepreneurial market on OMM's. Bibliometric studies usually include a citation analysis, where papers' citations are an influent measure (proxy variable). This proposition rests on the assumption that those papers heavily cited can be considered hors concours at that scope [11]. Thenceforward is possible to stress the most prominent publications Table 1 drawing on the citations number as an attribute indicator.

Considering the distribution chart Fig. 3 of total citations year-by-year (where total amount is 2647 citations) it is reasonable to consider that, taking into account the last four years, less relevant content has been published. The foremost publications take place throughout the 2006–2014 time range (as highlighted by the trend line) and 2012 the year belonging of the pivotal publication, Khosrowshahi and Arayici [4], aforementioned, with 109 citations. This single publication accounts for nearly 30% of the number of citations of the referred year.

3 Results and Discussions

The employed criteria for categorization embraces the assessment of survey field, the main publication purpose and the MM's focal area of adoption. In light of these perspectives, there are publications that earned more than one classification. The

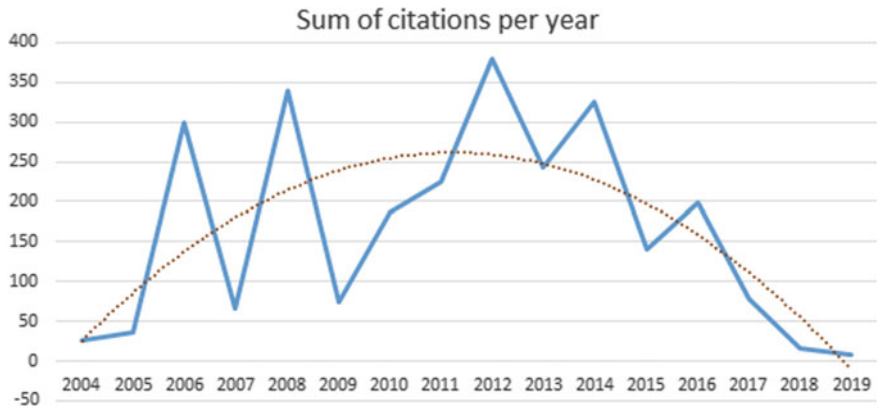

Fig. 3 Sum of sample citations—breakdown by year

Table 2 Results of classification criterial for organizational maturity models

Classification	No	Classification	No
Project management (PM)	34	Human resource, ergonomics, health and safety management (HEHSM)	24
Knowledge management (KM)	32	Process management (PRM)	20
Business management and strategy (BME)	30	Supply chain management (SCM)	15
Information technology (IT)	30	Risk management (RM)	14
Performance management (PFM)	30	Innovation management (IM)	13
Quality management (QM)	30	Industry 4.0 concept (I4.0)	02
Total			274

same criteria were applied to all abstracts. Drawing on, as an attribute indicator, the publications number for each classification; it is possible to stress relevant research fields at the OMM's theoretical-scientific universe Table 2. Listed in ascending order: PM, KM and, with the same publications number, the BMS, IT, PFM and QM.

I4.0 field retains the smallest number of publications (2 papers) accounting for solely 0.7% of the total classification results. Nevertheless, amidst the abstracts appreciated the most cited paper (118 citations) is 'A Maturity Model for Assessing Industry 4.0 Readiness and Maturity of Manufacturing Enterprises' [6]. It is legitimate to accept that the data obtained do not support the assumption that scientific community provides content in parallel with the practitioners, managers and scholars' needs and expectations in search for OMM's embedded in I4.0 concept. Considering the last four years, less relevant content has been published Fig. 3 whereby foremost publications take place at the 2006–2014 range time. It is legitimate to accept that there is no scenario to support that the scientific community provides content in parallel with the needs. It is also possible to highlight the most

Fig. 4 Total number of citations—breakdown by classification

prominent research fields Fig. 4 drawing on the total citations number (distributed through each classification pertained) as an attribute indicator. Listed in ascending order: IT, PM and PFM. The IT subject spotlight is mainly due for the aforementioned article 'Roadmap for implementation of BIM in the UK Construction Industry' [4], with 109 citations, and therefore, with the impact evaluation approximately 24% on the classification at issue. HEHSM, within the scope of the OHS, is the less relevant research field with an impact about 3% overall, so it is also legitimate to accept that the scientific community is not yet focused on developing this subject.

The network diagram Fig. 1 points out the keywords (also their correlations) embodied into the OMMs' context, also the surrounding environment, and highlights terms such 'industry', 'technology', 'project', 'organization', 'culture' and 'improvement'. Considering the most relevant research fields, namely PM, KM, BMS, IT, PFM, QM and the demand for I4.0 content, it is legitimate to accept the results above discussed constitutes a corollary of this visual mapping outcome.

4 Conclusions

It is imperative to burst the status quo, the immutability. Evolving is a natural process of any organism or organization and safety culture is a critical feature for the corporate maturity. Adaptability and changeover to ripeness are themselves innovation; hence, to leverage the shift it is mandatory prospecting the trends for the future. The data assessed supports the theory that there is an increased interest from the academic community and entrepreneurial market on OMM's. Inasmuch, the pivotal fields are IT, PM, PFM and I4.0. Those entailed in the theoretical-scientific universe of the subject, concluded throughout scrutiny of diverse data nucleus,

what brings validity for inferences. The visual mapping diagram stressed the correlations and includes the actual trends, i.e., the evidences of research convergence. Those results are suitable for extrapolation as trends for forthcoming environment in the macroeconomics, technological, business management and externalities that drive the research and the MMs' adoption. The connections outlined are a prospectus distinguishing thereby the power of the cluster analysis method. In practice, IT, PM, PFM, I4.0 and HEHSM domains are opportunities for further research thus catalyzing the organizational maturity and safety improvement in a continuous cycle. Pointing out I4.0, to buffer shortcomings, i.e., fulfillment scholars, practitioners and managers needs for information that interprets the new industrial revolution phenomenon. Moreover, in a *paradoxum* and spite of the increased interest, less relevant content has been published in last four years in the OHS domain. In addition, not only the acknowledged fields are opportunities for deepening but the whole OMMs' is a prospective subject to critical review.

An organizational model is not, itself, feasible or unfeasible. Success arises according the companies' ability to implement and operationalize it. The universalization of models can be ineffective in capturing the organizational reality, therefore, on this paper is encouraged the proper shift administration: considering obstacles, organizational specificities and complexities of externalities. This due confluence bears fruit to sustainable evolution of the organization and a successful effort to maturity.

5 Limitations and Future Research

The sample analyzed was extracted from Scopus database and, thus, bounded to it, which arises a limitation and an opportunity for future research. The same methodology and bibliometric analysis can be adopted throughout samples from distinct databases and performing results: data crossing from various sources can provide insights and either validate, or not, the robustness of the conclusions. To the abstracts content analysis is associated some bias which introduces noise into the results. Another opportunity for future research is the development of a network diagram, i.e. the visual arrangement, for every a pre-fixed period aiming evolutionary gearshifts detection on the subject. The timeline scrutiny of the research behavior can booster forward-looking insights. Also, to develop research avenues concerning the OHS management topic is of utmost importance. From the results a question emerges: why the safety performance and its maturity is a topic not growing concurrently with the industrial development? Further research should address this issue.

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References

1. Domingues, P., Sampaio, P., Arezes, P.M.: Integrated management systems assessment: a maturity model proposal. J. Cleaner Prod. **124**, 164–174 (2016). https://doi.org/10.1016/j.jclepro.2016.02.103
2. Domingues, J.P.T.: Sistemas de gestão integrados: desenvolvimento de um modelo para avaliação do nível de maturidade. Ph.D. thesis, University of Minho, Portugal (2013)
3. Grant, K.P., Pennypacker, J.S.: Project management maturity: an assessment of project management capabilities among and between selected industries. IEEE Trans. Eng. Manag. **53**(1), 59–68 (2006). https://doi.org/10.1109/TEM.2005.861802
4. Khosrowshahi, F., Arayici, Y.: Roadmap for implementation of BIM in the UK construction industry. Eng. Constr. Architectural Manag. **19**(6), 610–635 (2012). https://dx.doi.org/10.1108/09699981211277531.
5. Kilubi, I.: Investigating current paradigms in supply chain risk management—a bibliometric study. Bus. Process Manag. J. **22**(4), 662–692 (2016). https://doi.org/10.1108/BPMJ-05-2015-0060
6. Schumacher, A., Erol, S., Sihn, W.: A maturity model for assessing industry 4.0 readiness and maturity of manufacturing enterprises. Procedia CIRP **52**, 161–166 (2016). https://doi.org/10.1016/j.procir.2016.07.040
7. Sternad, D., Krenn, M., Schmid, S.: Business excellence for SMEs: motives, obstacles, and size-related adaptations. Total Qual. Manag. Bus. Excellence **30**(1–2), 151–168 (2019). https://doi.org/10.1080/14783363.2017.1300054
8. Van Eck, N.J., Waltman, L.: {VOSviewer} manual. Univeristeit Leiden, Leiden (January). Retrieved from https://www.vosviewer.com/documentation/Manual_VOSviewer_1.6.1.pdf (2013)
9. Van Looy, A., de Backer, M., Poels, G.: Defining business process maturity. A journey towards excellence. Total Qual. Manag. Bus. Excellence **22**(11), 1119–1137 (2011). https://doi.org/10.1080/14783363.2011.624779.
10. Vogel, R.: The visible colleges of management and organization studies: a bibliometric analysis of academic journals. Organ. Stud. **33**(8), 1015–1043 (2012). https://doi.org/10.1177/0170840612448028
11. Zupic, I., Cater, T.: Bibliometric methods in management and organization. Organ. Res. Methods **18**(3), 429–472 (2015)