A review about maturity models development process, Case of performance management in Education

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Abstract

Maturity models aim to evaluate and improve an organization's practices and to enhance capabilities by defining an improvement roadmap. Being developed initially to support Information Technology (IT) organizations, maturity models have presented confirmed benefits for experts and practitioners in capacity building.

In the last years, we have witnessed a growing interest for maturity models in the scientific community as a support tool for organizations in a wide range of areas and specialties. The variety of methodologies and methods being used for their development have, however, been questioned by scientists in their theoretical foundations and have been nuanced in their rigor and relevance. Faced with that, some scholars have proposed guidelines and attempted standards for their development process. Recently, a growing number of authors referred to these proposed guidelines and standards in the development of maturity models, but the majority continued to use 'Ad-hoc' methods justifying their relevance and their rigor.

This work will provide a literature review about methodologies, methods, and guidelines used by the scientific community in the development of maturity models across different sectors. Recent findings and conclusions in the field will be discussed to define an appropriate methodology to develop a maturity model for performance management in Education systems.

Keywords

Maturity Models, Methodologies for Maturity Models development, Performance Management in Education, Education Systems Performance.

1. Introduction

In the recent years, maturity models have undergone major growth in different domains. Both as informed approach for continuous improvement or as means of self or third-party assessment. This has led, on the one hand, to a substantial adherence to the concept by organizations in several areas until it has become the right way to sit improvement of governance structures. on the other hand, this has aroused the interest and the growing attention of the research community (Pereira & Serrano, 2020). Thus, we have witnessed the production of significant scientific work ranging from the development of maturity models to the proposal of new methodological guides and standards for their development to meet a need for relevance and scientific rigor.

Despite this growth, recent literature reviews confirm a lack of consensus among the scientific community on the adoption of standardized methodologies and methods so that a good number of researchers adopt 'ad-hoc' methods for the maturity models they propose. That said, what we can note overall is the general trend towards the adoption of standard methods and approaches or methods which are certainly "Ad-hoc" but which meet the requirement of scientific rigor and relevance (Pereira & Serrano, 2020).

This paper explores through a literature review, scientific approaches to develop maturity models. this implies methodologies, methods and guidelines. We used performance management in Education as a field of application to give insights about criteria that guide the choice of the approach for the development of a maturity model as well as the considerations necessary to take into account to ensure the relevance and rigor being sought. Section 2 explores the maturity models' literature through a focus on concepts and a review of standards used in maturity models development. Section 3 explores through literature reviews methodologies, methods and guidelines being used in the development of maturity models and highlights the principal finding and conclusions as an application, Section 4 proposes appropriate methodology and methods to develop a maturity model for performance management in Education system after performing a two-step analysis. First, an analysis and a classification of a sample of articles dedicated to maturity models development and extracted from the literature review. Second, a discussion about the principal features of "PM in Education". Finally, Section 5 provides some concluding remarks and discusses some potential utilization of the research outputs.

2. Overview of maturity models

a. Maturity models and related concepts

'Maturity' can be defined as: "The state of being complete, perfect or ready" (Mettler, 2011). The concept of maturity model was originally presented by Gibson and Nolan (1974) to assess the maturity of an information system (IS). A maturity model is a conceptual model that consists of a sequence of discrete maturity levels for a class of processes in one or more business domains, and represent an anticipated, desired, or typical evolutionary path for these processes (Becker, *et als.,* 2009).

The key elements of maturity models are dimensions, maturity levels and maturity model instrument (Aki, 2015). Dimension and its subcomponents define the specific capability areas to be evaluated, the evaluation variables (or the assessment items) to be measured and the reasons why these variables are chosen. The Maturity model instrument defines how these variables are measured. This is done with maturity levels. Maturity levels describe the stage in stable conditions or coherent modes of operation in each of the evaluation variables. The initial stage of maturity is characterized by an organisation with little capacity in the field under consideration. The highest level represents a total maturity with a conception of perfect modes of operating in each of the evaluation variables.

From there, two notions relating to maturity models can be drawn. (1) The maturity profile which is the overall status of an organization, which combines all the necessary evaluation variables. The evaluation is "constructed" by a comparison between a set of criteria and characteristics, provided by a maturity model, and the organization activities behavior, shown in a gradual scale, assigning a state or a maturity level to an organization capability. (2) The maturity progression path is an improvement path to enhance organization's capabilities by, displaying the best procedures to increase process's effectiveness and efficiency in accordance with good management practices (Pereira & Serrano, 2020). Advancing on the evolution path between the two extremes (The initial stage of maturity and the highest level of maturity) involves a continuous progression regarding the organization's capabilities or process performance.

It should be noted that the term 'maturity' is in most instances reflected in maturity assessment models on a one-dimensional manner, either focusing on: (1) process maturity, i.e., to which extent a specific process is explicitly defined, managed, measured, controlled, and effective. Or (2) object maturity, i.e., to which extent a particular object or product reaches a predefined level of sophistication. Or on (3) people capability, i.e., to which extent the workforce is able to enable knowledge creation and enhance proficiency. Thus, the ideal case is obtained when the model designed for reproducing the state of maturity likewise considers an improvement of object, process, and people abilities (e.g., teach the workforce how to collect customer requirements in a standardized manner by using standardized means). But in general path of maturity progression can be only with two enhanced factors, notably object and process maturity or in one direction only. Understanding these different ways of progressing the level of maturity is a crucial task in the development of a maturity assessment model and especially important when testing the model with respect to its validity (Mettler, 2011).

b. The Capability Maturity Model (CMM)

Maturity models have been widely used in various management research fields and a multiplicity of different instantiations have been developed in science and practice. The popularity of maturity assessment models and other normative models was especially boosted by the introduction of the Capability Maturity Model (CMM) proposed by

Carnegie Mellon University in the late 1980s. Since its development, the maturity model concept has been widely adopted and used in a number of management. The SEI has created six maturity models in total and has recently incorporated three legacy CMMs into one maturity model now named the Capability Maturity Model Integration – CMMI. Thus, the CMM has gained such global acceptance and reached the level of a compliance standard that high maturity scores are one of the requirements for accepting off-shoring partners (Bruin *et als.,*2005).

While maturity models are used to support organizational improvement, Capability Maturity Model (CMM) are focused on the improvement of organizational processes (SEI 2002). The Software Engineering Institute defines CMM as 'a description of the stages through which software organizations evolve as they define, implement, measure, control, and improve their software processes'. In fact, CMM is essentially a process maturity framework focused on the information systems function. It's covering processes such as: People Capability Development, Software Acquisition, System Engineering and Integrated Product Development. For each process, the CMM model addresses different practices when process maturity is to be incremented from one stage to the next (Umit *et als.,* 2014).

Basically, CMM sets out fixed levels and a path that an organisation can follow to develop progressively more sophisticated management practices. It shows the steps in progressing from a level of management typical of a start-up organisation to the strong, effective, operational management capabilities associated with a more mature and strategically sophisticated organisation. A CMM contains a hierarchy of statements of standards and options, for guidance in assessing the level of maturity and directing the organisation to goals of a higher level of maturity. By focusing on the issues and implementing the common features, the organization matures (Jääskeläinen & Roitto, 2015). The CMM is organized into five maturity levels: Initial, Repeatable, Defined, Managed, and Optimizing. Each maturity level is associated with a number of processes that have to be implemented. In the lowest level, processes are (typically) undocumented and in a state of dynamic change, tending to be driven in an ad hoc, uncontrolled and reactive manner by users or events. This provides a chaotic or unstable environment for the processes. The more mature the processes are documented, established and the focus is more and more on continually improving process performance through both incremental and innovative technological changes (Aho, 2009).

3. Literature review of maturity models development

Following the Capability Maturity Model (CMM) success as a support tool for IT organizations, it has been noted the growing interest for maturity models in the scientific community and practitioners in a variety of domains (Tarhan et als., 2016). In fact, the CMM has been widely accepted as standard and adopted over a wide range of areas. From an academic perspective, the number of publications on maturity models has increased significantly over the past decade (Lasrado et als., 2015). However, this growth has not been accompanied, initially and in most cases, by the adoption of methodologies and methods that respect the necessary scientific rigor and relevance (Mettler, 2011; Lasrado *et als.,* 2015).

It is true that scientific work, that questioned the theoretical foundations of the maturity models and proposed guidelines and standardizing development process, remains punctual (Mettler, 2011; Bruin et als., 2005) and the adoption of these standards and guidelines by authors is limited. Overall, however, there is a general trend towards compliance with the necessary scientific rigor and relevance, by adopting "Ad-hoc" methodologies and methods (Lasrado *et als.,* 2015; Pereira & Serrano, 2020).

Some of the literature continue to "confuse" the definition of the methodology and methods concepts (Pereira & Serrano, 2020). We will recall the distinctions between these two concepts brought by two researchers.

For Mackenzie & Knipe (2006) Methodology is "*The overall approach to research linked to the paradigm or theoretical framework*" and method is "All the s*ystematic modes, procedures or tools used for collection and analysis of data"* (Pereira & Serrano, 2020).

Crotty (2011) proposed a more concrete definition for the two concepts. Methodology is defined as "*The strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes"* and method as*" The techniques or procedures used to gather and analyze data related to some research question or hypothesis"* (Pereira & Serrano, 2020).

In the following, we will review the methodologies, methods, and guidelines used by the scientific community to develop maturity models. An analysis is subsequently carried out in order to choose the adequate method to develop a maturity model for Performance Management in Education.

a. Methodologies for maturity model development

According to a recent Systematic Literature Review (Pereira & Serrano, 2020) investigating, through 109 articles found, methodologies, methods, and guidelines being used in the development of maturity models, there is only two established methodologies used by scientific community: Design Science Research and Action Research. The latter being the less adopted (2%). Even though, the research highlighted, in one hand, the large number of articles for which the methodology is not specified, especially research carried out in the last decade. In the other hand, the increased adoption of "Ad Hoc" methodologies that are still a big part of the total (is almost 1/3 of all the articles). In the following literature review, the Action Research methodology is briefly described but the Design Science Research is more detailed as being the most used of the methodologies established by the research community to develop maturity models. In fact, according to Dresch *et als.,* (2015), Design Science Research serve to maintain the rigor and relevance necessary for investigative research since it is adapted to areas dealing with management problems and to bridge the gap between what is developed in academia and what is applied in organizations.

i. The Action Research methodology

Based on the traditional sciences paradigm, the Action Research is one of the main research methodologies used in management-related studies. The Action Research aims to solve or explain the problems that are found in a given system. It produces knowledge both for practice and theory. Like other traditional methodologies, the Action Research is exploratory, descriptive, and explanatory. However, the main feature of the Action Research that distinguishes it from the others methodologies, is the obligation to take concrete actions on the ground by the members of the system being studied and the researcher in action research who is not simply an observer but takes an active role in the investigation. In fact, he may be a participant in the implementation of a system; and, at the same time, he may wish to evaluate an intervention technique. It's important to note that action must not be trivial but should be perceived as important to the studied context, thus justifying the reasons for the investigation. Moreover, it is fundamental that the researcher understands the context in which the study will take place as well as the results that are expected at the end of it, and set up a monitoring throughout the whole cycle established for conducting the action research. Finally, the result of the study must be checked against the existing theoretical basis and the proposed solutions must be implemented to evaluate the results (Dresch *et als*., 2015).

ii. The Design Science Research methodology

1. Design Science (DS) as a new paradigm of the research

Research conducted under the paradigm of traditional sciences, results in studies that focus on explaining, describing, exploring, or predicting phenomena and their relationships with each other. Scholars, more than a quarter of a century, have highlighted the limitations of this approach in conducting research that aims to study the design, construction, or creation of a new artifact (i.e., something that still does not exist) or to focus on problem solving. Thus, the Design Science was recommended as a new epistemological paradigm for conducting research (Dresch *et als.,* 2015). The discussion of Design Science formally began with Simon (1996), he promoted the idea that understanding phenomena, systems, and problems is not sufficient. Instead, a science interested in how things should be is what is needed. Thus, he introduced the "The Science of Design" or "Design Science" concept as a science that is dedicated to proposing ways of creating (constructing and evaluating) artifacts that have certain desired properties, i.e., how to design artifacts (Dresch *et als.,* 2015).

Design Science occupies thus a middle ground between traditional scientific approaches, mostly descriptive, and knowledge produced in practical situations for solving problem in specific context. It has been pointed out as a suitable research approach when researchers need to work in close collaboration with organizations, for testing new ideas in a real context (Lasrado et als., 2015). Five areas of study as areas strongly related to Design Science: Engineering, Medicine, Law, Architecture, and Education (Simon ,1996). The Design Science has roots in engineering and also in other applied sciences. However, Information Systems was the area that exhibited faster development regarding the use of Design Science as an epistemological paradigm for the advancement of knowledge. The 2000s were when Design Science started to be used by authors in the areas of management and organizations specially for maturity model development. The goal was to propose a science that could facilitate the conducting of research in the area and that considered not only rigor but also relevance (Dresch *et als.,* 2015).

2. Fundamental Concepts of Design Science:

Since the genesis of DS through Simon work "The Sciences of the Artificial - Herbert Simon (1969)", several scholars have taken an interest in the new paradigm and have developed a set of concepts. Thus, the fundamental concepts related to Design Science may be summarized as follows: Design science, Artifact, Satisfactory solutions, Classes of Problems, Pragmatic Validity concepts (Dresch *et als.,* 2015).

- **Design Science concept:** Contrary to what you might think, Design Science aims to create knowledge and not only to apply knowledge. When creating, knowledge about "how to design" is generated. In other words, Design Science is a science that focuses on "Design". In contrast with traditional sciences, this science does not aim to discover natural or universal laws that would explain certain behaviors of the objects that are being studied but instead aims to understand the "(…) cognitive process by which the design that defines them was developed (…)" (Le Moigne 1995). Above all, Design Science is a science that seeks to develop and design solutions to improve existing systems, solve problems, or even create new artifacts that contribute to better human performance, whether in society or in organizations.
- **Artifacts concept:** Something that is man-made; "i.e., "artificial things can be characterized in terms of functions, goals, adaptation" (Simon 1996, p. 28). It's an interface between the inner environment- the substance and organization of the artifact itself, and an 'outer environment' the surroundings in which it operates" of a given system (Simon 1996, p. 29).
- **Satisfactory solutions concept:** Solutions sufficiently appropriate for the context in question; the solutions should be feasible to the reality and does not necessarily need to be optimal solutions. It is essential to emphasize that although Design Science is focused on problem solving and solution-oriented, it does not seek optimal outcomes (common to areas such as Operational Research). A satisfactory outcome for the context in which the problem is found is the aim (Simon 1996). In this sense, solutions that are sufficient for problems in which the optimal solution is inaccessible or impractical to be implemented are sought (Simon 1996). This goal implies in clearly defining what satisfactory results are. The definition of a satisfactory result can be achieved in two manners: (i) Consensus among the parts involved in the problem or (ii) Advancement of the current solution, compared to the solutions generated by previous artifacts.
- **Classes of Problems concept**: Design Science recognizes that problems in organizations tend to be specific. These specificities could somehow prevent generalizable knowledge. Indeed, van Aken (2004) argued that the solutions proposed by Design Science should allow for generalization of the prescriptions, i.e., they must be generalizable to a particular "Class of Problems". That the "Classes of problems" concept can be defined as an "Organization that guides the trajectory and development of the knowledge in the Design Science context".
- **Pragmatic Validity concept:** the concept is thought to have arisen with Venable (2006) who stated that research conducted under the Design Science paradigm not only proposes solutions to practical problems but can also contribute to improving theories. Theorization occurs with a new idea or as a concept for a new technology that can facilitate the solving of a problem. These ideas, once they are developed through research, can contribute to improving theories. Such theories should be, above all, useful. Regarding this utility, it is worth noting the importance of the concept of pragmatic validity for Design Science. The premise of Design Science is that the research conducted under its paradigm, in addition to being rigorous and scientifically valid, should also seek pragmatic validity, i.e., utility. In this context, pragmatic validity seeks to ensure the utility of the solution proposed to the problem; considers: cost/benefit of solution, specificities of the environment in which it will be applied and the actual needs of those interested in the solution.

3. Design Science Research (DSR) as a methodology:

DSR is a methodology that is conducted under the paradigm of design science to operationalize research (Dresch *et als.*, 2015). In the following we highlight the key features of DSR. The methods using DSR, being formalized by several authors for its operationalization, are presented in the following paragraphs.

The Design Science Research establishes and operationalizes research when the desired goal is an artifact or a recommendation (Dresch *et als*., 2015). The key feature of DSR is that it is oriented to the solving of specific problems to obtain a satisfactory solution for the situation even if the solution is not optimal. However, the solutions generated by Design Science Research should be liable to generalization for a specific class of problems. This generalization for a class of problems can enable other researchers and practitioners in various situations to use the generated knowledge. Thus, the artifacts that are constructed or evaluated by Design Science Research may result in an improvement of theories (Hevner & Chatterjee, 2010; Venable, 2006).

From scientific research methods point of view, DSR is a rigorous process which requires that the research meets a set of basic criteria (Hevner et als., 2004): (1) Design as artifact: Research conducted by DSR must produce viable artifacts in the form of construct, model, method or instantiation; (2) Problem relevance : the purpose of DSR is to develop solution to solve important and relevant problem of the organization; (3)Design evaluation: a well-executed evaluations methods must be performed to demonstrate the utility, the quality and efficacy of the artefact; (4) Research contribution: Research conducted by DSR must provide clear and verifiable contribution in the specific areas of the development artifacts; (5) Research rigor: Research conducted by DSR should be based on an application of rigorous methods in both the construction and the evaluation of artifacts; (6) Design as research process: the search for an effective artifact requires the use of means that are available to achieve the desired purposes, while satisfying the laws governing the environment in which the problem is being studied . (7) Communication of the research: Research conducted by DSR must be presented to both an audience that is technology oriented and one that is more management oriented (Dresch *et als.*, 2015).

b. Methods for maturity model development:

Through two recent systematic literature reviews (Lasrado *et als.,* 2015; Pereira & Serrano,2020), important conclusions can be drawn concerning the maturity model development methods. In fact, Pereira & Serrano, (2020), through the109 articles analyzed, highlighted a big variety of methods used (14 different methods were found). However, it can be stated that there are two types of methods that are most used in this kind of development tool. On the one hand, methods like Literature Review, Systematic Literature Review, or even Critical Literature Review where the focus is placed on the search of what other researchers have created, and the information of what had already been created over the years. On the other hand, methods like Interviews, Case Studies, or even the surveys that it is possible to characterize as a pragmatic approach, where many of the authors preferred to be in "contact" with experts and with professionals and practitioners in the organization, which can contribute with advice and experience. More specifically, Pereira & Serrano, (2020) noted that the main method utilized more and more by the authors was the Literature Review, which is applied in 68% of the total articles. They noticed that Interviews method, being used in a substantial number too (20%), seems to be a suitable method for MM development.

Based on 34 articles that constituted the literature corpus about maturity model development in Information System area, Lasrado *et als.,* (2015) concluded that the literature review is the most used method before the conception of maturity model and deriving dimensions and levels, which is then verified and tested through focus groups, Delphi methods and/or interviews.

c. Guidelines and standardization efforts for maturity models development

Guidelines for the development of a maturity model can be seen as a methodology composed by the description of the steps that are necessary to develop a maturity model (Pereira & Serrano,2020). A variety of guidelines were created by the researchers based on DSR methodology, in order to develop an "artifact". These "guidelines" are intrinsically relevant for the maturity model development even if not being specifically for this type of development. One of the examples found in the recent systematic literature reviews (Lasrado et als., 2015; Pereira & Serrano,2020) was of: (1) Hevner et als., (2004); (2) De Bruin et als., (2005); (3) Becker, (2009) and (4) Mettler et als., (2010) guidelines. In the following, table 1 summarizes maturity models development steps for the three latest guidelines.

Apparently, the utilization of Becker guidelines is increasing, perhaps not just for his well-established steps, but also for the flexibility that these guidelines may have (Pereira & Serrano,2020). Moreover, Becker guidelines have the Hevner guidelines subjacent, which are connected with DSR methodology (Pereira & Serrano,2020). This amplifies the Design Science Research as a feasible and practicable research methodology in this type, of development. Becker guidelines are specific for maturity models, and for this reason, it will make more sense to adopt these guidelines instead of Hevner's or De Bruin's in the maturity model's construction (Lasrado et als., 2015).
In percentage terms guidelines based methods remain, however, less adopted in comparison with the "Ad-hoc" methods. One of the possible hypotheses that justifies this fact is the poor existence or inexistence of guidelines for specific areas (Pereira & Serrano,2020).

The two first are top-down approaches (first defining maturity levels and then creating dimensions and adjusting measures to fit the definitions) and the third is a bottom-up approach (requirements and measures are determined first with definitions of stages later). De Bruin (2005) has given a clear answer to the question: "what approach to use in

Table 1. Three Meta models for maturity models development process.

Common steps in the research design (Dresch et als., 2015)	De Bruin *et als.,* (2005) 6 steps	Becker, (2009) 8 steps	Mettler *et als.,* (2010) 7 steps
1- Identify need or new opportunity		**(1)** Specify problem (scope, domain, target group) **(2)** Compare existing problem solutions (existing models)	**(1)** Identify need and specify problem domain
2- Define scope	**(1)** Define scope of model application and use	**(3)** Define development strategy (Design structure with justification)	**(2)** Define scope of model application and use
3- Design model	**(2)** Design model structure and deployment method **(3)** Populate model structure	**(4)** Develop model structure (iterative) **(5)** Specify deployment and evaluation method (iterative) **(6)** Implement deployment measures (iterative)	**(3)** Identify operationalization measures **(4)** Implement deployment and evaluation method **(5)** Apply model
4- Evaluate design	**(4)** Test model structure	**(7)** Evaluate deployment measures (validation of MM in reality)	**(6)** Evaluate model structure and deployment method
5- Reflection and learning	**(5)** Deploy model **(6)** Maintain the model's growth and use	**(8)** Iterative Continuation Outcome of evaluation decides rejection, otherwise improve continuously.	**(7)** Synthesis of design and continuous learning
6- Communication of results	Not explicitly mentioned	In step (5). Through documentation and software tools. It must be targeted with regard to the conditions of its application and the needs of its users. But results must also be documented in detail as scientific finding (Becker, 2009).	Implicitly mentioned in step (7).

developing maturity models and when?". In fact, a top-down approach works for a relatively new domain as there is little evidence of what is maturity among the community. In a well- established domain, the focus would be on how maturity is measured rather than what represents maturity, thus requiring the bottom-up approach. In summary, all the three approaches (Table 1) advocate a step by step iterative sequential approach for developing a maturity model and emphasize operationalization and validation to ensure practical relevance and to increase the rigor of maturity models. In addition to what has been stated, scholars highlighted the importance of the clear identification of contributions to the knowledge bases in DSR and the communication of these contributions to the stakeholder communities, especially in developing maturity models (Hevner et als., 2004; Becker et als., 2009; Gregor & Hevner, 2013). In fact, this problem arises because much of the work on DSR particularly on maturity models development sees the development of the model itself as the whole point and, accordingly, there has been little emphasis on what it means to make a contribution to generalized knowledge. Thus, the Gregor's work which has consisted in a DSR publication schema as DSR knowledge contributions may be of great utility to provide sufficient advice on how maturity models development must be communicated and its contributions to knowledge established (Gregor & Hevner, 2013).

d. Lessons learned about maturity models development process

Recent systematic reviews in analyzing methodologies and methods for developing maturity models noted interesting finding and conclusions which can be used for the development of the following paragraph (Lasrado et als., 2015; Pereira & Serrano, 2020). Thus, it is observable that:

- The Ad Hoc methodology is the dominant methodology adopted by researchers; consequently, it use a big variety of methods used.
- Design Science Research methodology utilization is growing more and more in scientific community for maturity models development
- The literature review was the most used method, being adopted in the majority of the articles that utilized the Design Science Research or Ad Hoc methodologies. Interviews were ranked second.
- Researchers who prefer comparing what has already been done and use experts experience to construct their maturity model are more likely to use the literature reviews method; those who prefer more pragmatic methods closer to the organization needs are more likely to use Interviews.
- The majority of authors are preferring adopting their own guidelines instead of those established by the scientific and academic community. However, the utilization of Becker guidelines is increasing given its flexibility for any kind of domain;
- In order to meet the requirements of relevance and rigor, recent research tend to emphasize on empirical methods to derive or validate maturity models.

4. Towards the development of a maturity model for Performance Management in Education

To determine the methodology and the method to be adopted to develop a maturity model for Performance Management in Education, the present study propose a two-step approach. First, we extract some maturity models development articles found in the literature and perform an analysis and a classification of methods and validation instruments. Second, we discuss and stop the choice for the development of maturity model for Performance Management in Education.

a. Maturity models development: comparative analysis

The choice of the maturity models development examples to be analyzed was not arbitrary. In fact, the focus was first on articles related to performance management maturity models development or similar topics. Second, a special focus was on recent articles that reflect new trends and good practices. An analysis and a classification of the extracted articles are presented in Table 2.

We choose five criteria for the classification: (1) Methodology: the article analysis seeks to determine whether a methodology has been adopted and specify its nature i.e. is it standard or Ad-hoc (Peirera, 2020); (2) Methods: idem we seek to determine all methods adopted and their nature i.e. is it a standard method or Ad-hoc method (Peirera, 2020); (3) Guidelines: we seek to determine whether a guideline has been adopted and specify its nature i.e. is it standard or Ad-hoc (Lasrado, 2015; Peirera, 2020). (4) Method Classification: According to Lasrado (2015) classification, method can be either qualitative, or qualitative, or derivative, or conceptual; (5) Validation instruments: the article analysis seeks to determine whether a validation step has been performed and to specify validation instruments adopted. In the following we propose to apply concepts learned on maturity models development through the literature review in the field of performance management in Education. To do this, it is necessary to agree on the main characteristics of this field of application. But before that, it is useful to recall some basic notions on Education.

a. Fundamental aspects of Educational Systems

Tree fundamental aspects related to Education are useful to recall:

(1) Education is "*the instrument both of the all-round development of the human person and of that person's participation in social life* (UNESCO,1992)";

(2) The scope of actions of Education: "*Education can take place at any age, through the actions of many institutions such as family, the community or the work environment. It can also take place through interaction with the natural*

Table 2. Maturity Models analyses and classifications

	PM related field	Methodology	Methods	Guidelines	Method Classification	Validation Instruments
Wettstein, T., & Kueng, P. (2002)	Yes	None	- Literature review - Cases studies - Interviews	None	Qualitative	None
Aho, (2009)	Yes	Constructive Research	Literature review + Case Studies	None	Conceptual	None
Marx et als., (2012)	No	DSR	Literature review Survey Focus group	Hevner et al., (2004) & De Bruin et al., (2005)	Quantitative	- Focus group
Barclay, (2014)	No	DSR	Literature review	Hevner et al., (2004)	Derivative	- Descriptive evaluation method with informed arguments
Aki Jääskeläinen, (2015)	Yes	DSR	Literature review	De Bruin (2005)	Quantitative	-Survey
Kreiling & Bounfour, (2020)	Yes	None	Literature review	None	Quantitative	-Focus group -Survey
Pažur Aničić & Divjak, (2020)	No	DSR	Literature review Case Studies Focus group	Mettler (2010)	Qualitative & Quantitative (Mixed)	-Focus group -Standards tests

environment, especially when such interaction is socially and culturally determined. From these many influences, school remains the most visible educational institution, and its role is central to the development of society. It aims at developing the potential of learners through the transmission of knowledge and the creation of competencies, attitudes and values that empower them for life in society" (UNESCO, 2006).

(3) Finally, the Education Sector or Education System is: "*A group of institutions (ministries of Education, local Educational authorities, teacher training institutions, schools, universities, etc.) whose primary purpose is to provide Education to children and young people in Educational settings*" (UNESCO, 2016).

b. Main features of Performance Management in Education

Performance Management (PM) in essence derived from management field. It creates the context for performance. It is a process that translates the mission, aims and values of an organization into individual objectives (Forrester, 2011). In Education, Performance Management put the focus on improving school performance by establishing clear benchmarks, collecting and publishing data on student progress towards these benchmarks, and rewarding or sanctioning schools or sometimes individual teachers on their progress. The goal is to improve the Educational effectiveness, to reduce the disparities or the gap of pupil's performance according to the social or cultural origins (the equity), finally to control or to reduce the costs, that is to improve the efficiency (Benlhabib & Berrado, 2020).

The main features of Performance Management in Education can be summarized as bellow: (1) It is actually adopted by developed countries, as both a democratic necessity and a rational course of action which allowed normalisation across the public and private sectors. For many of these countries the experience goes back more than thirty years. Scholars noted several good practices and lessons learned in this area. Studies and benchmarks are regularly carried out such us (PISA, TIMSS, PIRLS). (2) Scholars have shown that Performance Management is an effective lever for improving performance in schools if it is properly administered. It is true that successful approaches differ from one

country to another, but some principles and good practices are identical (Benlhabib & Berrado, 2020). (3) Given the difficult context of schools in some developing countries, Performance Management can lead to complex situations but it remains an effective way to improve the effectiveness and efficiency of schools and confirm its best adaptability in the context of developing countries (Benlhabib & Berrado, 2019; Verger, 2017; Hanushek & Wößmann, 2007).

All this suggests that today, we can see favorable conditions for the development of a maturity model for Performance Management in Education. First, given the general consensus reached by international organizations that influence Education policies, on the need for countries to adopt Performance Management. Second, the presence of reference frameworks developed by these organizations that bring together a set of benchmarks and good practices and the existence of several model countries (developed or developing) who have accumulated proven and effective experience in Performance Management in Education (Benlhabib & Berrado, 2020). Moreover, what motivates this work more is the demonstrated added value of maturity models for Performance Management development through promoting organizational learning as well as enabling efficient and effective assessment of the performance management practices of the organization (Bititci, *et als.,* 2015).

c. Towards the development of a maturity model for Performance Management in Education.

Taking into account the main conclusions of the literature review and the main features of the field of Performance Management in Education, we propose the following approach to develop an adapted maturity model for Performance Management in Education. In this framework we suggest the methodology to be adopted, the Maturity Models Constructs Method and validation instruments and guidelines to be applied.

- Methodology**:** The research will follow the Design Science paradigm. First, it considers both the rigor and the relevance of the research in connection with real-world problems (Hevner et al., 2004). Second, it was found to be the common approach for the design of maturity models (Lasrado *et als.,* 2015; Peirera, 2020).

- Maturity Model Constructs Method and validation instruments: we currently have sufficient elements that can be used as a reference to building maturity model for Performance Management in Education. The Bottom-up approach is therefore appropriate (De Bruin *et al.,* 2005). In fact, we'll perform a literature study that will be followed up by a conceptual maturity model, which is then verified and tested through focus groups, Delphi methods and/or interviews before operationalizing the measuring instrument. In fact, the qualitative method will be more suitable for Maturity Models validation than the quantitative one given the specificities of Education and the current trends in Maturity Models development (Lasrado *et als.,* 2015). knowing that Maturity Models validations will be carried out with practitioners as well as experts and academics.

- Guidelines: Still in line with current Maturity Models development trends, the construction of the Maturity Models will be aligned with existing reference processes (Becker *et al.,* 2009; De Bruin *et al.,* 2005) but may be supported by an "Ad-Hoc" approach without a mandatory and integral application of these guidelines.

5. Conclusion

Maturity models development is revealed to be a growing field of research in recent years. However, it has not been untroubled by criticism. The most important point of critique is its poor theoretical basis, and the lack of standards that lead to the expansion of ad-hoc methodologies and methods.

The present work is useful for beginning researchers in this field. it presents a global overview for the approaches adopted for the development of Maturity Models, recalls the methodologies and methods recommended and emphasizes the criteria to be taken into consideration when choosing the overall development approach.

Based on our analysis of literature and good practices, we have given in this work the first traits for the development of a maturity model for performance management in Education where we have suggested a methodology to be adopted, the Maturity Model Constructs Method and validation instruments and Guidelines to be applied.

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