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# A systematic literature review on maturity models for information systems in higher education institutions

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## ABSTRACT

Maturity models have been introduced over the last five decades as guides and references for information system (IS) management in organizations from different sectors. In the education sector, maturity models have also been used to evaluate higher education institutions (HEIs) across several dimensions, such as information and communication technology (ICT), management, process management, course curricula, course/HEI accreditation, e-/m-learning, online courses and pedagogical strategies. In fact, HEIs are faced with enormous complexity due to the specificity and quantity of their processes. Based on the guidelines concerning a methodology for a systematic literature review, the maturity models of different subareas of education are identified and categorized in this paper. For each maturity model associated with HEIs' ISs, the appropriate methodology for development and validation is identified, as well as the scope, stages and their dimensional characteristics. This study highlights the need to develop an IS maturity model that supports HEIs in their core business activities and management.

## KEYWORDS

Stages of growth; maturity models; higher education institutions; education information systems; management

## Introduction

In recent decades, we have seen many changes in the HEI sectors of developed countries. In the past, in some of these countries, higher education was highly restricted in terms of the capacity of students. The expansion of this kind of education (OECD, 2018) has put HEIs under enormous pressure in providing the required services and capacity. In addition, new teaching paradigms (Bologna Treaty), viewing the student as a 'customer', opening up universities to enterprises, knowledge transference and HEI rankings and competition have forced the HEI sector to reinvent higher education and adopt agile management methodologies in order to adapt to constant changes in the market environment.

The HEI sector is faced with a new reality in terms of implementing information ecosystems comprising a large spectrum of platforms, such as academic management enterprise resource planning (ERP), financial ERP, student relationship management, learning management systems, content management systems, survey tools, business intelligence, current research information systems and repository of publications. Given this situation, HEIs could

benefit from an integrated vision of all these individual platforms in the form of a unique information system (IS) capable of supporting their transversal organizational processes. Managing such complex ecosystems of platforms and processes requires powerful tools to evaluate and guide HEIs in terms of the capability to support these organizational processes and a high level of IS integration. According to Manjula and Vaideeswaran (2012), increasing competence in the ICT and education sectors calls for a process maturity evaluation methodology for education organizations. Such a maturity model could provide HEIs with a means for the self-evaluation of the maturity of their IS and guide their managers to achieve higher levels of maturity of these systems, with a substantial positive impact on the quality of the teaching and services to students. External evaluation can also benefit from the existence of these tools. HEI rankings and national agencies of accreditation could apply maturity models to establish rankings, approve new courses or certify courses or HEI. Accordingly, we started our research by determining the scope of the maturity models found in these information ecosystems which support all HEI activities: teaching, research and management.

Throughout our research, we intend to discover whether there are tools to manage such IS ecosystems in terms of maturity models. At this preliminary stage of our research, however, a literature review has been carried out in order to identify any eventual gaps in existing maturity models. After following a systematic approach to our literature review methodology, we have considered a selection of previous studies that we consider to be related to ours. Then, we have focused our analysis on these studies in order to understand their capacity to address the requirements of these models. Accordingly, this article seeks to contribute to this research field by answering relevant questions concerning the state of the art for maturity models in the HEI sector.

The next (second) section presents a brief overview of maturity models in the IS field. Then, in the third section, the research methodology adopted for the purposes of the literature review is described. The fourth section presents the results of the literature review, that is, the maturity models for education information systems and technologies (ISTs) are described and categorized. Finally, the fifth section presents a summary and the paper's closing remarks.

## **Maturity models in IST management**

The concept of maturity models is increasingly applied in the IS field as a necessary approach for continuous improvement (Paulk, Curtis, Chrissis, & Weber, 1993) and for its evaluation (Fraser, Moultrie, & Gregory, 2002). Since its initial conception in the early 1970s (Gibson & Nolan, 1974; Nolan, 1973), a multitude of different instances have been developed in science and practice. However, as organizations face constant pressures to achieve and maintain competitive advantages by inventing and reinventing new products and services, as well as reducing costs and time to market while at the same time improving quality, there is a continuing need for the development of new maturity models, since they help decision makers to achieve these goals (Mettler, 2009). On the other hand, through the incorporation of formalism into the improvement of activities, decision makers within organizations can determine whether or not the potential benefits are being achieved.

Maturity models are capable of responding to many different challenges. These models provide information for organizations in order to address the problems they face in a structured way, providing a reference point to assess their capabilities and a roadmap for improvement (Caralli & Knight, 2012). In other words, maturity models offer an orientation through an evolutionary process by incorporating procedures for improving activities (Mettler & Rohner, 2009).

Various maturity models have been proposed over time, both for the development of individuals and for the general evolution of organizations, or the particular evolution of the IS management function. These models mainly differ in terms of the number of stages, variables in evolution and focus areas (Carvalho, Rocha, & Abreu, 2016a; Mettler & Rohner, 2009; Rocha, 2011). Each of these models identifies certain characteristics that specifically define the objectives of the next stage of growth. These types of models can be applied situationally within education in order to strategically plan for IST maturation, based on the degree of alignment between the education organization (e.g., HEI) strategy and the selected growth path, as well as associated investments and improvement activities.

Based on the literature review carried out in this project, as well as complementary studies, we found no comprehensive and detailed HEI maturity models that assess IS maturity in its various aspects. In fact, a content analysis of scientific articles, manuals, white papers, reports and websites, all with information on maturity models in the area of education, revealed the lack of any maturity models with dimensions or influence factors that are considered in the same way, using different weights according to their relative importance.

In view of these constraints, it was considered opportune to develop a research project that would extend the knowledge of maturity models applied in HEIs and in turn facilitate improvements in the practice of evaluating and promoting IS maturity in this sector. Based on the description of the problem, the following research question was formulated:

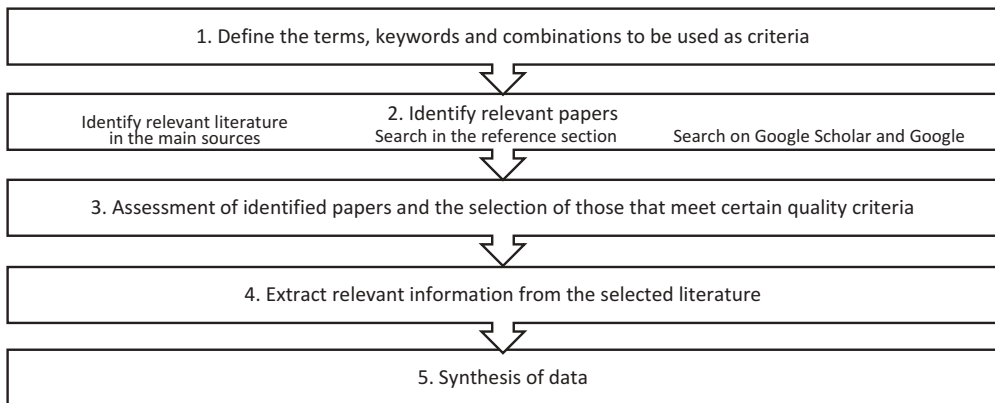
- *What are the models, which consist of several maturity-influencing factors and maturity stages, that can be applied to ISTs in HEIs?*

## Methodology adopted for the literature review

By aiming to conduct a comprehensive and wide literature review, it was necessary to define a strategy (Carvalho, Rocha, & Abreu, 2016b) in order to identify and systematically analyse the available work on maturity models in education ISTs. An initial review established the criteria with which to select the most suitable approach and establish the strategies to be applied to this project.

The first strategy by Webster and Watson (2002) suggests a structured approach with three basic steps: identifying the relevant literature in the main sources (i.e., 'leading journals') and recognized conferences. Then, the authors suggest conducting a search in the reference section of the studies identified in the first step in order to identify potential studies of relevance. Finally, they suggest searching, via the Web of Science, for studies that cite those identified in the previous two steps.

The second strategy, proposed by Tranfield and Smart (2003), involves five steps for a systematic review of the literature. The first stage defines terms, keywords and



**Figure 1.** Methodology adopted for the systematic literature review.

combinations to be used as the criteria to be applied in the review. The second phase is to identify relevant studies that contain the keywords and terms defined above. In the third phase, an assessment is carried out of the identified papers and a selection made of those that meet certain quality criteria. In the fourth phase, the relevant information from the selected literature is extracted. Finally, in the fifth phase, a synthesis of the data is performed. With regard to Tranfield and Smart’s approach, no clear procedure was found for the identification of relevant work in the second phase. Consequently, this phase in Tranfield and Smart’s approach was replaced by the three basic steps described by Webster and Watson (Figure 1).

## Main keywords

The terms and keywords defined as literature search criteria were considered to be the most relevant to the literature on the maturity models of education ISTs, as written in English. In particular, ‘maturity model’ and ‘education’ were combined in several research contexts, namely, the title (TI), abstract (AB) and subject (SU) were used for the search iterations.

TI “maturity model” AND TI education OR AB “maturity model” AND AB education OR SU  
“maturity model” AND SU education

The search criteria were applied to the literature review. Given that Tranfield and Smart (2003) did not suggest any procedure for this stage, we followed the approach proposed by Webster and Watson (2002) by introducing two changes: in the first step, the main sources were replaced by major web platforms for scientific literature and in the third step of this approach, the b-on<sup>1</sup> platform was replaced by the search engines Google and Google Scholar.

## Data sources and searches

The literature search was performed on studies published in academic journals and conference proceedings up to January 2018. In order to simplify the search process, we

opted to use the b-on platform, which aggregates the results of searches involving multiple databases, such as the ACM Digital Library, ISI Web of Knowledge, SCOPUS, SpringerLink, Elsevier/Science Direct and the IEEE Computer Society Digital Library. Afterwards, we conducted data analysis to identify related references, as suggested by Webster and Watson (2002). Finally, given that the disclosure of much of the information on maturity models of education ISTs has been accomplished through technical reports, research and white papers, we performed a much more extensive search using the search engines Google Scholar and Google to identify other relevant work for the study.

### **Inclusion and exclusion criteria**

The following inclusion criteria (at least one criterion) were used:

- The study proposes or presents a complete and methodologically validated maturity model from the educational area with a description of its different stages.
- The study proposes or presents a way in which to evaluate the maturity of an education IST.
- The study proposes or presents a maturity model, which being from the educational area, focuses on the ISs of education institutions.

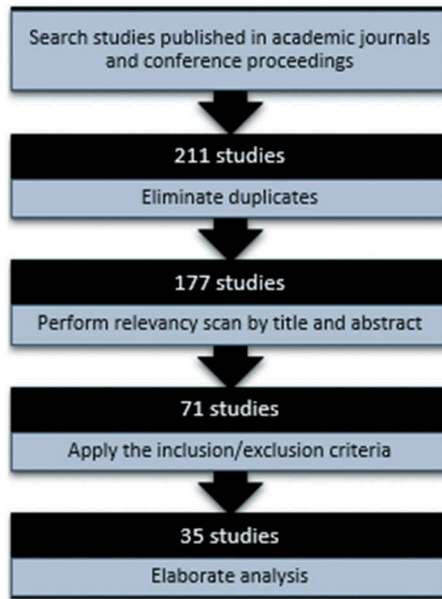
The following exclusion criteria were used:

- The study proposes or presents an incomplete maturity model, i.e., a model that is still in the process of being developed and validated.
- The study proposes or presents an application in an educational context of an existing maturity model.

The study selection was performed in two stages. In the first stage, Author 1 made all the extractions on the b-on platform and then listed all the studies that could be included for analysis in a spreadsheet. All potentially relevant studies were selected based on titles, abstracts and subjects, in accordance with the inclusion and exclusion criteria. In the second stage, each of the studies selected from the previous stage was read in full and analysed again, according to the inclusion and exclusion criteria. In addition, the related papers cited by these studies were evaluated and included in the review if they were considered relevant to the search area. The decision of the studies to be considered in our work was made in agreement with Author 2. Only in some cases, when the decision was not conclusive, Author 3 gave his contribution.

### **Data extraction and quality assessment**

Data extraction and quality assessment were undertaken by one author and confirmed by another. Data related to the research approach, scope, stages, dimensions, evaluation tools and potentialities and vulnerabilities were extracted and categorized.



**Figure 2.** The refinement steps and resulting number of articles.

### Data synthesis and analysis

The extracted data were tabulated and summarized, with any disagreement resolved with a discussion and when necessary, by involving a third author. They were grouped into the following topics: name, research approach, scope, stages, dimensions, evaluation tools, year and authors. Finally, we summarized the potentialities and vulnerabilities identified in the reviewed articles.

**Figure 2** presents the refinement steps and the resulting number of articles after applying the Tranfield and Smart (2003) and Webster and Watson (2002) strategies.

### Results

As a result of this literature review, it was found that maturity models for education ISTs have been developed by involving different types of entities, including national and international education organizations, research organizations and academic experts in this domain.

It was also found that two approaches exist: on the one hand, highly specialized models focused on one education subsystem and on the other hand, more comprehensive models, i.e., models representing an education institution's IS as a whole. It was also found that most of the analysed maturity models do not disclose the design process nor the research options for development and validation in order to avoid compromising the researchers' work.

It appears that CMM (Paulk et al., 1993), together with its successor CMMI (SEI, 2010), is the reference model for the design of maturity models in the education sector. This model has served as an inspiration for dozens of maturity models in the various areas of IST, with the education sector being no exception. Regarding the number of maturity stages, there

are models involving three stages, as in the case of eQETIC (Rossi & Mustaro, 2015) and up to eight stages in the case of ICTMMEI-DV (Bass, 2011).

In the literature review mentioned above, the following maturity models were identified in the educational domain:

- e-learning (eMM (Marshall & Mitchell, 2002), Hadullo, Oboko, & Omwenga, 2017), ELMM (Iskander, 2013), MLMM (Alrasheedi & Capretz, 2013), Aol-CMM (Marchewka, 2013), IA-LMM (Fernando, Dahanayake, & Sol, 2005))
- Online courses (OCDMM (Neuhauser, 2004), OCQMM (Gu, Chen, & Pu, 2011), eQETIC (Rossi & Mustaro, 2015))
- Strategy and learning (Kenny, 2006)
- Student engagement (SESR-MM (Clarke, Nelson, & Stoodley, 2013))
- Education of senior management (EIM-MM (Newman & Logan, 2008))
- Intelligence training/education (Middleton, 2007)
- IS curriculum (CMMI-ISC (White, Longenecker, Leidig, & Yarbrough, 2003) CDMM (Thong, Yusmadi, Rusli, & Nor Hayati, 2012) ERP-EDMM (Antonucci, Corbitt, Stewart, & Harris, 2004))
- Learning process (LPMM (Thompson, 2004), (Mitasiunas & Novickis, 2011))
- Project management (PMMM (Demir & Kocabaş, 2010))
- Academic management ((Silva & Cabral, 2010) ITIL-ITSMM (Zhen & Xin-yu, 2007))
- Continuing/quality education (HEMM (Garg & Sharma, 2014), (Boehm, Jasper, & Thomas, 2013) CMM-QE (Manjula & Vaideeswaran, 2012))
- Engineering/computation education (EECMM (Petrie, 2004) CEMM (Lutteroth, Luxton-Reilly, Dobbie, & Hamer, 2007) TeaM (Reci & Bollin, 2016) CM/sup 3/(Kajko-Mattsson, Forssander, & Olsson, 2001) (Collofello & Ng, 2001))
- Intellectual capital (ICMM (Perez, Martinaitis, & Leitner, 2015))
- Web accessibility (Silva, 2013)
- Accreditation of education institutions (MRAEIS (Petrie, García, & Giraldo, 2009))
- Green governance (Green IT Governance (Putri & Muljoredjo, 2014))
- ICTs in education (ICTE-MM (Solar, Sabattin, & Parada, 2013) ICTMMEI-DV (Bass, 2011))

Given that HEI ISTs are the main focus of our research, several maturity models have been proposed within the education IST domain, although these models are still at an early stage of development or in most cases, not comprehensive regarding all IST dimensions or without a particular focus on higher education. These models are critically centred on the management of the IS of an education institution, either from a global perspective or by defining only one of its dimensions. We should note that the majority of the established models are not strictly concerned with IST. In these cases, IST is a variable/domain, which is evaluated in the respective maturity model. Accordingly, in our literature review, we considered five maturity models, which are summarized in Table 1. In addition to the identification of each model and its authors, we present the scope, number of stages, research method adopted in its development, considered dimensions, assessment tool and the model used as a reference for its development.

These all suggest attributes that the organization should possess, which should be positioned at each stage. However, most maturity models do not explicitly identify any

**Table 1. Summary and comparison of maturity models for HEIs' ISTs.**

Designation	Focus	Stages	Research Methods	Dimensions	Assessment Tool	Reference Model	Author/ Year
ICTE-MM	ICT in school education	5	Pilot study, survey, interviews	Educational management, infrastructure, administrators, teachers and students	Web support tool	CMMI	Solar et al., 2013
CMM-QE	Process improvement and quality education	5	Structured equation modelling/PLS, questionnaires, cluster analysis, analysis of variance	Not applicable	No	CMM	Manjula & Vaideeswaran, 2012
OCQMM	Online course quality	4	Survey	Learning resources, teaching platform, teaching process, monitoring and evaluation	No	CMM	Gu et al., 2011
ICTMMEI-DV	ICT equipment and use	8	Survey	Institutional, resource milestones, potential learning outcomes	No	-	Bass, 2011
eQETIC	Online education	3	Exploratory research	Didactic-pedagogical, technology, management, support, tutorial, evaluation	No	-	Rossi & Mustaro, 2015



Table 2. Strengths and weaknesses of maturity models for HEIs' ISTs.

Designation	Strengths	Weaknesses	Gaps in HEIs
ICTE-MM	<ul style="list-style-type: none"> <li>Involves the entire academic community (in terms of vision, digital literacy and efficiency of use of ICT)</li> <li>Based on international standards</li> <li>Adopts a web support tool to perform automatic maturity evaluation</li> <li>Based on a known and established reference model such as CMMI</li> <li>Suggests critical variables (and weights) for a key domain to be positioned at a specific maturity level</li> <li>Presents a methodology for modelling the relationships between latent variables</li> <li>The model uses critical factors (key indicators) to be quantified in order to assess the maturity level of education institutions</li> <li>Based on a known and established reference model such as CMM</li> <li>In particular, the context of online courses and correspondence education is comprehensive in terms of key areas</li> <li>Based on a known and established reference model such as CMM</li> <li>Structured across multiple dimensions, which aim to cover all processes in the academic arena</li> </ul>	<ul style="list-style-type: none"> <li>Considers neither the business process definition nor documentation in any of the dimensions or variables</li> <li>Does not adopt a known methodology for the development of the maturity model</li> </ul>	<ul style="list-style-type: none"> <li>Focused on the use of ICT, not access to IST capability in supporting the institution's business process</li> <li>Generic maturity model for school educational processes, thus not focused on HEIs</li> </ul>
CMM-QE	<ul style="list-style-type: none"> <li>Presents a methodology for modelling the relationships between latent variables</li> <li>The model uses critical factors (key indicators) to be quantified in order to assess the maturity level of education institutions</li> <li>Based on a known and established reference model such as CMM</li> <li>In particular, the context of online courses and correspondence education is comprehensive in terms of key areas</li> <li>Based on a known and established reference model such as CMM</li> <li>Structured across multiple dimensions, which aim to cover all processes in the academic arena</li> </ul>	<ul style="list-style-type: none"> <li>The dimensions and variables are not clearly presented</li> <li>Does not provide an automatic maturity evaluation tool</li> <li>Does not adopt a known methodology for the development of the maturity model</li> <li>Difficult to replicate in other institutions</li> <li>Insufficient level of detail in terms of how the six key process areas are discussed</li> <li>Does not provide any methodology or analytical approaches for determining the maturity of courses or the school</li> <li>Does not provide an automatic maturity evaluation tool</li> <li>Does not adopt a known methodology for the development of the maturity model</li> <li>The model has not yet been fully validated</li> <li>Not adapted for developed countries</li> <li>Does not present process areas and maturity practices that encompass the various entities</li> <li>Does not provide an automatic maturity evaluation tool</li> <li>Does not adopt a known methodology for the development of the maturity model</li> <li>The model has not yet been fully validated</li> </ul>	<ul style="list-style-type: none"> <li>Generic maturity model for school educational processes, thus not focused on HEIs</li> </ul>
OCQMM	<ul style="list-style-type: none"> <li>In particular, the context of online courses and correspondence education is comprehensive in terms of key areas</li> <li>Based on a known and established reference model such as CMM</li> <li>Structured across multiple dimensions, which aim to cover all processes in the academic arena</li> </ul>	<ul style="list-style-type: none"> <li>Insufficient level of detail in terms of how the six key process areas are discussed</li> <li>Does not provide any methodology or analytical approaches for determining the maturity of courses or the school</li> <li>Does not provide an automatic maturity evaluation tool</li> <li>Does not adopt a known methodology for the development of the maturity model</li> <li>The model has not yet been fully validated</li> <li>Not adapted for developed countries</li> <li>Does not present process areas and maturity practices that encompass the various entities</li> <li>Does not provide an automatic maturity evaluation tool</li> <li>Does not adopt a known methodology for the development of the maturity model</li> <li>The model has not yet been fully validated</li> </ul>	<ul style="list-style-type: none"> <li>Despite being a model for course quality, it does not consider facilities for students, administrative support or other specific IS aspects of HEIs in their successful pursuit of their mission and duties</li> </ul>
ICTMMEI-DV	<ul style="list-style-type: none"> <li>Based on international standards</li> <li>The model is intended to be prescriptive, advocating best practice in ICT infrastructure development in an education institution</li> <li>Improvement is obtained in a staged and progressive way</li> <li>Suggests attributes for an entity to be positioned at a specific maturity level</li> </ul>	<ul style="list-style-type: none"> <li>Does not provide an automatic maturity evaluation tool</li> <li>Does not adopt a known methodology for the development of the maturity model</li> <li>The model has not yet been fully validated</li> </ul>	<ul style="list-style-type: none"> <li>Strictly focused on ICT</li> <li>Issues related to management process definition and other relevant aspects of ISs are not considered</li> <li>Despite HEIs being the subject of this model, it is aligned with primary education levels and is not well suited to HEIs</li> </ul>

(Continued)

**Table 2. (Continued).**

Designation	Strengths	Weaknesses	Gaps in HEIs
eQETIC	<ul style="list-style-type: none"> <li>● Based on international standards, as well as other research papers and frameworks issued by associations and governments</li> <li>● In particular, the context of online education is comprehensive in terms of key areas</li> <li>● The model structure is defined, as well as its mode of application</li> <li>● Considers the principles of continuous process improvement</li> <li>● Suggests implementation rules for an entity to be positioned in a specific maturity level</li> </ul>	<ul style="list-style-type: none"> <li>● Does not provide an automatic maturity evaluation tool</li> <li>● Does not adopt a known methodology for the development of the maturity model</li> <li>● The model has not yet been fully validated, as it has only been developed in the course of exploratory research</li> </ul>	<ul style="list-style-type: none"> <li>● Despite being a model for digital educational solutions, it does not consider blended learning and traditional face-to-face teaching, nor facilities for students, administrative support or other specific IS aspects of HEIs in their successful pursuit of their mission and duties</li> </ul>

assessment tool. Only the ICTE-MM provides a tool with which to assess the fulfilment of requirements in order to effectively place an organization at a certain level. Next, a brief description will be provided regarding each maturity model, while Table 2 synthesizes the strengths and weaknesses of all these maturity models and identifies some gaps in terms of their implementation by an HEI (the main concern of this literature review).

**ICT in (school) education maturity model (ICTE-MM)** (Solar et al., 2013): The ICTE-MM is a holistic model which embraces several domains that can influence the successful use of ICT in schools. In their work, the authors identified five leverage domains: educational management, infrastructure, administrators, teachers and students.

**Capability maturity model for quality education (CMM-QE)** (Manjula & Vaideeswaran, 2012): The CMM-QE is used to evaluate the maturity of the multidimensional factors and attributes of an education system. This model evaluates the education system's engineering process from multiple perspectives, i.e., academic, infrastructural, administrative, facility-based, etc.

**Online course quality maturity model based on evening university and correspondence education (OCQMM)** (Gu et al., 2011): This model seeks to assess the quality of online courses in evening university and correspondence education. The OCQMM can guide those institutions that provide adult education in order to improve the implementation quality of online courses.

**ICT maturity model in education institutions in developing countries (ICTMMEI-DV)** (Bass, 2011): This maturity model defines the ICT infrastructure resource levels that education institutions should accomplish in order to achieve their primary organizational objective, expressed in the form of student learning outcomes.

**eQETIC: a maturity model for online education** (Rossi & Mustaro, 2015): Rossi and Mustaro's eQETIC model (quality model for educational products based on information and communication technology) is focused on the quality of online educational solutions and grounded in an approach that aims for continuous process improvement.

## Summary and closing remarks

Most of the aforementioned models are still in the early stages of development and in premature phases of affirmation and consolidation, on account of being proposed by their authors in the course of exploratory studies. In fact, only a few of the identified models have been adopted and they have received scant attention from the academic community. Additionally, most of these models are not sufficiently explicit in terms of the way in which they were developed and validated. Furthermore, because they are poorly detailed, they do not provide the tools needed to determine the maturity stage nor structure the characteristics of maturity stages. In the case of the adoption of a tool for assessing system maturity, it was found that most of the models, besides focusing on the assessment of the system's maturity, pay attention to a maturity improvement path. However, not all have a properly systematized process necessary to move to a higher maturity level. The authors have also not applied weights to any of the influencing factors (or dimensions), that is, in the assessment process of the overall maturity of education ISTs, all influencing factors have the same importance. Based on our own analysis to date, it was possible to verify that no model has been developed based on the guidelines for the development of the methodologies of

maturity models (Becker, Knackstedt, & Pöppelbuß, 2009; de Bruin, Freeze, Kulkarni, & Rosemann, 2005; Mettler, 2010).

In light of the collection of analysed maturity models focused on HEIs and other education institutions, we have categorized the established models according to five main scopes: (1) management of the institution; (2) process management; (3) learning and e-/m-learning practices and quality; (4) course/HEI external accreditation and evaluation in terms of quality; and (5) ICT.

In the literature, the identified maturity models belonging to the fifth scope are very focused on technology itself and not on their capacity to support today's HEIs (as well as other types of education institutions) in their respective challenges: dynamic and agile management, new teaching strategies, flexible formative portfolios and knowledge management. We are convinced that all the four remaining scopes can benefit, provided HEI information ecosystems stay optimized.

Regarding to the geographical scope, only one of these models is focused on developing countries, while the remaining ones tend to be oblivious to this issue.

As a result of this study, to the authors' knowledge, none of the identified models has sufficiently focused on the capability of IS support's complex, diversified, interoperable and dynamic organizational processes in the HEI sector. From this perspective, it is necessary to design a new model to fill the gap. This new model should include the main influence factors with different weights depending on their relative importance, while its development should be informed by rigorous scientific methods of conceptualization and validation. This model should also identify key IST strategic areas for HEIs and apply international standards of management to the IST and HEI context. Such a maturity model will enable the evaluation of HEIs in terms of how their IST practices and strategies support their institutional processes at all levels: that is, organizational strategies, management, operative management, teaching and research. Accordingly, it can empower the HEIs and their human capital (administrators, staff, teachers and students). In short, the contribution of this article is a systematic literature review, which is focused on the systematization of knowledge regarding maturity models in the educational area in general and HEI ISs in particular.

## Note

1. b-on is an online knowledge library offering research and higher education institutions unlimited and permanent access to complete texts from over 16,750 scientific international publications from 16 publishers. Available at: <https://www.b-on.pt/en/what-is-b-on/>.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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