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UNIVERSITY MATURITY MODEL – A BIBLIOMETRIC ANALYSIS

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ABSTRACT: In today's dynamic and competitive environment, universities play a key role in generating, transmitting, and applying knowledge and innovation. The growing interest in evaluating university performance at national and international levels has led to developing and applying university maturity models as effective assessment tools. This article aims to present various approaches to modelling university maturity. A bibliometric analysis was based on publications in the Web of Science and Scopus databases. The research query included TITLE-ABS-KEY ("maturity model" and universit*) for Scopus and TS = ("maturity model" and universit*) for the Web of Sciences database. A total of 123 publication records were analysed. Materials published between 1994 and 2024 in English were examined. A total of 123 publications were selected for the final analysis. Based on the literature review, key factors that may influence university maturity across nine areas were identified. A theoretical University Maturity Model (UMM) is also presented, which should undergo expert evaluation in subsequent stages. Findings suggest that the application of maturity models can significantly enhance universities' management and operational efficiency, offering valuable insights for policymakers in formulating educational policies.

KEYWORDS: maturity model, university

Introduction

In today's dynamic and competitive world, higher education plays a key role in creating, transmitting and applying knowledge and innovation. As a result, more and more attention is paid to functioning and evaluating universities at both national and international levels. Maturity models in universities are one of the tools that have become extremely useful in assessing universities.

Higher Education Institutions are complex organisations. Although autonomous, they have to execute a number of functions and develop a variety of procedures to ensure the fulfilment of their duties, which inevitably raise constant challenges. The number of functions they perform and the variety of procedures developed under their autonomy to ensure the accomplishment of all their duties raise constant management and administration challenges. Difficulties in procedure systematisation and in workflow analysis, evaluation, and optimisation carry problems not only to management itself but also to information systems design (Zacarias & Martins, 2011).

University maturity models are a comprehensive analytical tool that enables the assessment of various aspects of the functioning of higher education (university). These models allow the identification of strengths, areas for improvement and elaboration of development strategies by defining the level of maturity in areas such as management, teaching and learning, scientific research, technology transfer, international cooperation and social involvement. Since universities are organisations, maturity models have proven to be valuable in evaluating their process and determining by levels the path to academic excellence (Tocto-Cano et al., 2020). According to Mintzberg (1979), based on the interactions of people and the differentiation of their roles, the university is an organisation of "professional bureaucracies". A bureaucracy, for M. Weber, is an efficient organisation that defines even in the smallest details how things should be done. Also, Weber believed that bureaucracies are the most efficient way to organise large organisations and were a result of the inevitable rationalisation and personalisation of society (Chiavenato, 2019). In response to the need to measure the progress achieved by an organisation, which is also a university, maturity models have been created.

This article provides an overview of several university maturity models, highlighting their variety, applications, benefits, and drawbacks. Its goal is to showcase different methods for modeling university maturity.

Literature review

The definition of organisational maturity, although it may vary depending on context and source, generally refers to the degree to which an organisation is able to manage its processes resources, and achieve its strategic goals effectively and efficiently. It can be defined as the level of development of processes, structures, and technologies that allow the organisation to operate stable and predictably. Maturity commonly means reaching the final stage of development or process shaping, or the degree of intellectual, emotional or biological development of any individual organisation, person or unit (Głuszek & Martusewicz, 2015). P. Crosby, who, in 1979, in his book entitled Quality is Free, published the first maturity model, is believed to be a precursor of this term. It included a description of five levels of organisational skills in using quality management methods and tools. This model showed the development path for these skills, specifying what activities must be taken to reach the next level of maturity. According to Kalinowski (2011), process maturity is the ability of an organisation, including its processes, to systematically improve the delivered results in its operations. At a higher level of detail, the maturity of the process is viewed as the field to which processes are driven, well-defined, managed, flexible, measured and effective (Grajewski, 2012). In another approach, it is indicated that process maturity is the degree of optimal allocation of organisational resources in stable and measured processes (Grela, 2013). The maturity process is the awareness that the processes occurring horizontally within an organisation create that organisation (Brajer-Marczak, 2012a). Those processes need to be managed in an appropriate way. In addition, process maturity also indicates how the perception of processes fits into the company's strategy. On the one hand, the level of process maturity informs about the awareness of employees in terms of participation in business processes, and on the other hand, how the managers use the knowledge about processes in organisational development decisions.

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In another publication, Brajer-Marczak (2012b) defines the process maturity of an organisation as a state in which it is possible to repeatedly achieve the same result of processes (or characterised by a small, acceptable tilt) in relation to previously defined key factors. According to the same author, another definition of the above-mentioned process maturity is the ability to organise effective management processes supporting the achievement of strategic goals. Brajer-Marczak points out a two-fold relationship here: firstly, the goals of the processes must be a result of the strategic goals, and secondly – the achievements of planned process goals enable the implementation of the strategy.

Maturity models define the current state of the organisation that results from the way the organisation exists and its possibilities for the use of existing resources or previous experience, as well as what it is not possible to achieve in the future by applying department priorities and financial resources and methods of their implementation (Kosieradzka & Smagowicz, 2016). The maturity model is a set of diverse tools and practices that enable the assessment of the competencies of a given organisation in the field of management (OGC, 2007), as well as the improvement of key factors leading to achieving the assumed goals (Van Looy, 2014). In the literature on the subject of maturity models in organisations, you can find several dozen process maturity models. Szewczyk (2018) compared three maturity models: the Process and Enterprise Maturity Model (PEMM), the Business Process Maturity Model (BPMM) and Fisher's model. The first model of PEMM was developed by M. Hammer, a specialist in reengineering theory, in 2000-2006. According to this model, to determine process maturity, you have to analyse two areas: process enablers and enterprise capabilities (Hammer, 2007; cf. Power, 2007). The second model is Business Process Maturity Model (BPMM) which the owner is the Object Management Group. BPMM model points out five levels of process maturity: initial, managing, standardised, predictable and innovative (OMG, 2008). The third model is written by D.M. Fisher. The author of the model clearly emphasises the nonlinearity and complexity of the process of increasing the maturity of the organisation, in which he distinguishes and describes 5 levels of change (Fisher, 2014). Those levels are strategy, control, people, technology, and processes. For each of the levels mentioned before, Fisher's model defines five levels of maturity (silo organisation, tactically integrated organisation, process-driven, optimised organisation, and intelligent operational network).

Kosieradzka and Smagowicz (2016) compared twenty maturity models from seven management areas. Those seven areas are: process management, production management, project management, software development management, administration management, quality management, risk and continuity speed of action management. Below the authors systemised those models according to division (cf. Kosieradzka, 2016).

1. In process management:
   1.1. Business Process Maturity Model developed by OMG.
   1.2. Business Process Maturity Model developed by Gartner.
   1.3. Process and Enterprise Maturity Model developed by Hammer.
2. In production management:
   2.1. Productivity Management Model developed by Kosieradzka.
3. In project management:
   3.1. Project Management Maturity Model developed by Kerzner.
   3.2. PRINCE 2 (P2M) Maturity Model developed by Office of Government Commerce.
   3.3. OPM3 developed by Project Management Institute.
   3.4. P3M3 developed by Cabinet Office.
4. In software development management:
   4.1. Capability Maturity Model Integration developed by Software Engineering Institute.
   4.2. Process Maturity Framework.
   4.3. IT Service Management Maturity Model.
   4.4. Model Control Objectives for Information and related Technology developed by ISACA and IT Governance Institute.
5. In quality management:
   5.1. Quality Management Maturity Grid developed by Crosby.
   5.2. ISO 9004.
   5.3. EFQM developed by European Foundation for Quality Management.

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6. In risk and continuity speed of action management:
   6.1. Business Continuity Maturity Model developed by Virtual Corporation.
   6.2. Enterprise Risk Management Maturity Model.
   6.3. Risk and Insurance Management Society Maturity Model.
7. In administration management:
   7.1. Planning of institutional development.
   7.2. Common Assesment Framework.

As it is seen there are many relevant maturity models in literature. In one study, a list of three maturity models was pointed out. In other study, twenty maturity models were found. One more study shows nine categories of selected Maturity Models connected with universities (Tocto-Cano et al., 2020). Those are the categories:

1. Maturity models oriented towards teaching.
2. Maturity models oriented towards Information and Communication Technology (ICT).
3. Maturity models oriented towards student monitoring.
4. Maturity models for intellectual capital.
5. Maturity models for E-Learning.
6. Maturity models aimed at evaluating university entrepreneurship.
7. Maturity model oriented to the employability of graduates.
8. Maturity model oriented to the strategic planning of universities.
9. Maturity model for IT governance in university institutions.

In one more study (Duarte & Martins, 2013), it is shown comparison between nine educational maturity models. Most models found are based on CMM or on the staged representation of CMMI. The presented models by Duarte and Martins (2013) have the same five levels of maturity. They all suggest attributes that the organisation should possess to be positioned at each stage. However, unlike the model in which they were based, most teaching maturity models do not explicitly identify any key process areas. Only the models developed by Dounos and Bohoris (2010) and by Marshall and Mitchell (2002, 2004, 2005, 2006a, 2006b, 2008, 2009) provide these areas as well as the methodologies and evaluation techniques to assess the fulfilment of requirements, to effectively place an organisation in a certain level of maturity.

Also strengths and weaknesses of the educational maturity models are shown in his article. Those maturity models which focused on Higher education institution are:

1. eMM (Marshall & Mitchell, 2002),
2. MRAIES (Petrie et al., 2009),
3. ICTMMEI-DV (Bass, 2010),
4. CMMI-ISC (White et al., 2003),
5. OCDMM (Neuhauser, 2004),
6. LPMM (Thompson, 2004),
7. ITIL-ITSMM (Wang & Zhang, 2007),
8. CEMM (Lutteroth et al., 2007),
9. CMMI – TQM (Dounos & Bohoris, 2010).

Selection of models to present in this article is based on subjective assessment of the authors and is connected with university as an organisation.

Research methods

Researchers frequently use bibliometric analysis, particularly when exploring a specific research topic. Given the vast number of available publications, this method aids in the identification, synthesis, analysis, and critical evaluation of their content (Keathley-Herring et al., 2016; Gudanowska, 2017; Bornmann & Haunschild, 2017; Cichowicz & Rollnik-Sadowska, 2018; Glińska & Siemieniako, 2018; Siderska & Jadaa, 2018; Czerniawska & Szydło, 2020; Lenert-Gansiniec, 2021; Szpilko et al., 2023). The bibliometric analysis aims to provide knowledge about the main research directions in a field, research trends, changes in the number of publications over the years, the most productive authors, journals, countries, or research units (Niñerola et al., 2019; Szum, 2021).

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The research process was conducted following a methodology comprising seven distinct phases (Szpilko et al., 2023). These phases encompassed the (1) selection of bibliographic databases, (2) the choice of keywords, and (3) the criteria to narrow down the search for publications. (4) Subsequently, data extraction and selection was performed, (5) followed by the analysis of the selected publications. The last two phases involved (6) identifying research areas and (7) defining thematic clusters (Figure 1).

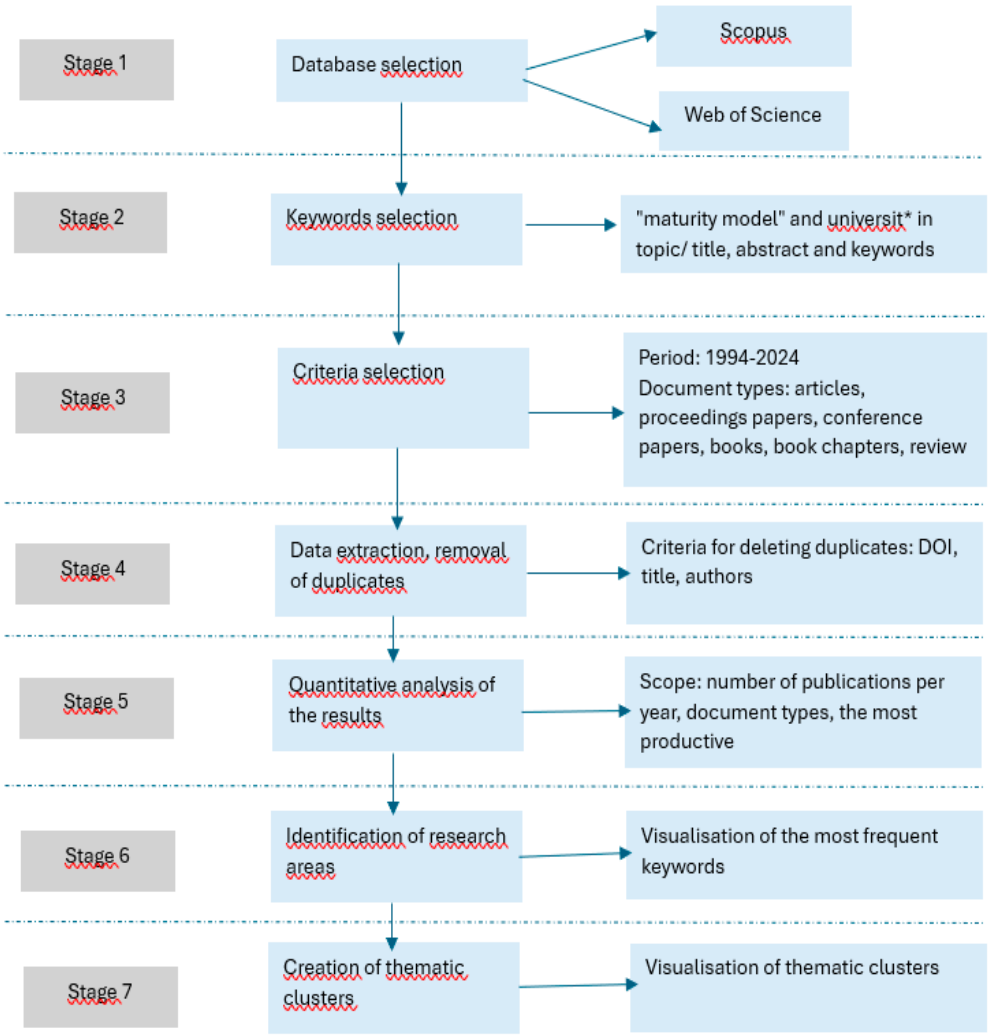

Figure 1. Methodology of bibliometric analysis

The bibliometric analysis was based on publications available in Web of Science and Scopus databases. It covers publications containing the phrases ("maturity model" and universit*) in the title, abstract and keywords. The search was conducted for materials published between 1994 and 2024 in English. Articles, proceedings papers, conference papers, books, book chapters and reviews were considered. Other publication types (early access, editorial materials, retracted publications, notes) were rejected. The results of the first search are presented in Table 1.

An initial search for the term "maturity model" and universit* across the entire set of articles in the first sample yielded 25 154 records in Scopus and 15 494 records in Web of Science. However, after initial analysis, it became apparent that many of these publications were not directly related to the study area. Only after narrowing the search criteria did the number of publications decrease. Ultimately, there were 151 records from the Scopus database and 132 from the Web of Science database.

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Table 1. Search results

Stage	Web of Science	Scopus
First search		
Research query	ALL: "maturity model" and universit*	ALL: "maturity model" and universit*
Number of articles before inclusion criteria	15 494	25 154
Number of articles after inclusion criteria	2 390	4 766
Second search		
Research query	TOPIC: ("maturity model" and universit*)	TITLE-ABS-KEY: ("maturity model" and universit*)
Number of articles before inclusion criteria	146	258
Number of articles after inclusion criteria	132	151
Content evaluation and final selection of articles	123	

Source: authors' work based on the Scopus and Web of Science databases.

In the next stage, the files were downloaded in CSV format. Subsequently, data from the two databases were merged, and duplicates were removed. Ultimately, after reviewing all the records, 123 publications were selected for assessment. From the authors' perspective, it was important to explore the interest in the topic over the years as well as the most frequently cited articles. The next step involved using the VOSviewer program to generate a map that reflects the co-occurrence of keywords in the analysed set of publications. The next step involved using the VOSviewer program to generate a map that reflects the co-occurrence of keywords in the analysed set of publications.

Results of the research

Initially, the authors observed a growing interest in the subject over the years (Figure 2). It is important to highlight that the exploration of issues related to university maturity models increased notably after 2008. Moreover, a substantially higher number of publications was identified in the Scopus database compared to the Web of Science.

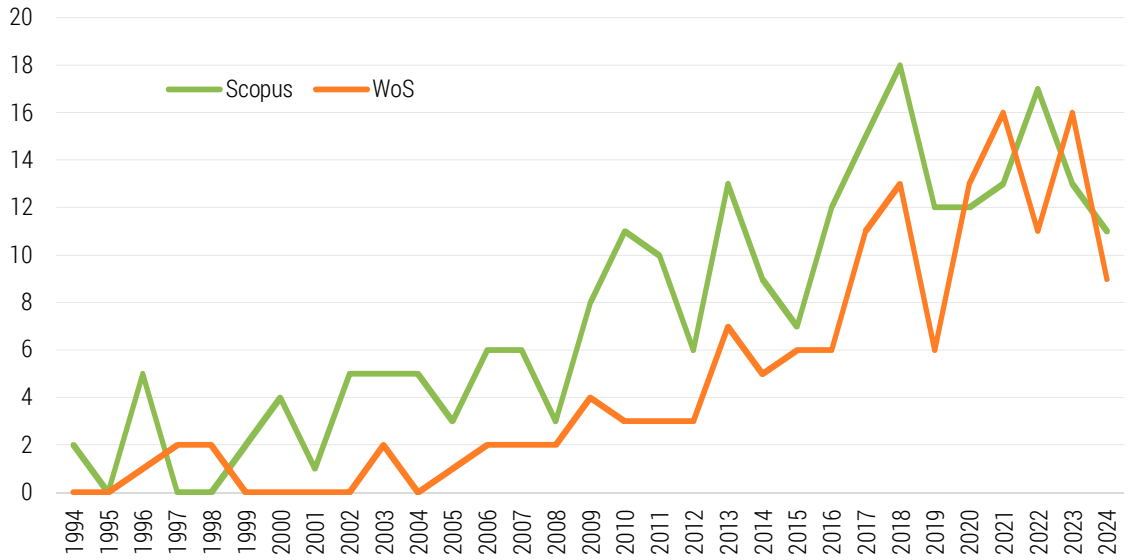

Figure 2. Number of publications in the field of university maturity model in Scopus and Web of Science (indexed from January 1994 to September 2024)

Source: authors' work based on the Web of Science and Scopus.

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The next question concerned the most frequently cited publications. It can be seen that an average number of citations was recorded in both databases. Noteworthy are the articles published in the Journal of Intellectual Capital (Table 2).

Table 2. The most cited articles related to the topic of uniformed services

No.	Authors	Article title	Journal	Number of citations	
				Scopus	Web of Science
1.	Ganzarain and Errasti (2016)	Three stage maturity model in SME's towards industry 4.0	Journal of Industrial Engineering and Management	262	202
2.	Secundo et al. (2016)	Managing intellectual capital through a collective intelligence approach: An integrated framework for universities	Journal of Intellectual Capital	145	115
3.	Secundo et al. (2010)	Intangible assets in higher education and research: Mission, performance or both?	Journal of Intellectual Capital	120	110
4.	Secundo et al. (2015)	An intellectual capital maturity model (ICMM) to improve strategic management in European universities: A dynamic approach	Journal of Intellectual Capital	110	112
5.	Pee and Kankanhalli (2009)	A model of organisational knowledge management maturity based on people, process, and technology	Journal of Information and Knowledge Management	91	54
6.	Secundo et al. (2018)	Intellectual capital management in the fourth stage of IC research: A critical case study in university settings	Journal of Intellectual Capital	84	91
7.	Secundo et al. (2017)	Mobilising intellectual capital to improve European universities' competitiveness: The technology transfer offices' role	Journal of Intellectual Capital	63	49
8.	Frondizi et al. (2019)	The evaluation of universities' third mission and intellectual capital: Theoretical analysis and application to Italy	Sustainability	61	45
9.	Dzimińska et al. (2018)	Trust-based quality culture conceptual model for higher education institutions	Sustainability	52	169
10.	Dayan and Evans (2006)	KM your way to CMMI	Journal of Knowledge Management	51	-
11.	Heinemann and Uskov (2018)	Smart university: Literature review and creative analysis	Smart Innovation, Systems and Technologies	39	-
12.	Secundo et al. (2016)	Measuring university technology transfer efficiency: a maturity level approach	Measuring Business Excellence	37	30

Note: N/A – not applicable.

Source: authors' work based on the Scopus and Web of Science databases.

In the context of bibliometric analysis, keywords frequently associated with the topic of university maturity modelling were identified. The analytical process utilised VOSviewer software. The resulting dataset consisted of 145 words or phrases that appeared at least three times in the keywords of 123 analysed articles. The dataset also included terms unrelated to the main topic of the analysis (e.g., 'article,' 'analysis,' 'survey,' 'literature review'). To systematise the keyword set, unnecessary terms (related to the topic of analysis) were intentionally excluded. Terms and abbreviations with similar meanings were standardised. The refined dataset contained 98 keywords. The most frequent terms and their interrelations are illustrated in Figure 3. The names of the individual clusters are presented in Figure 4.

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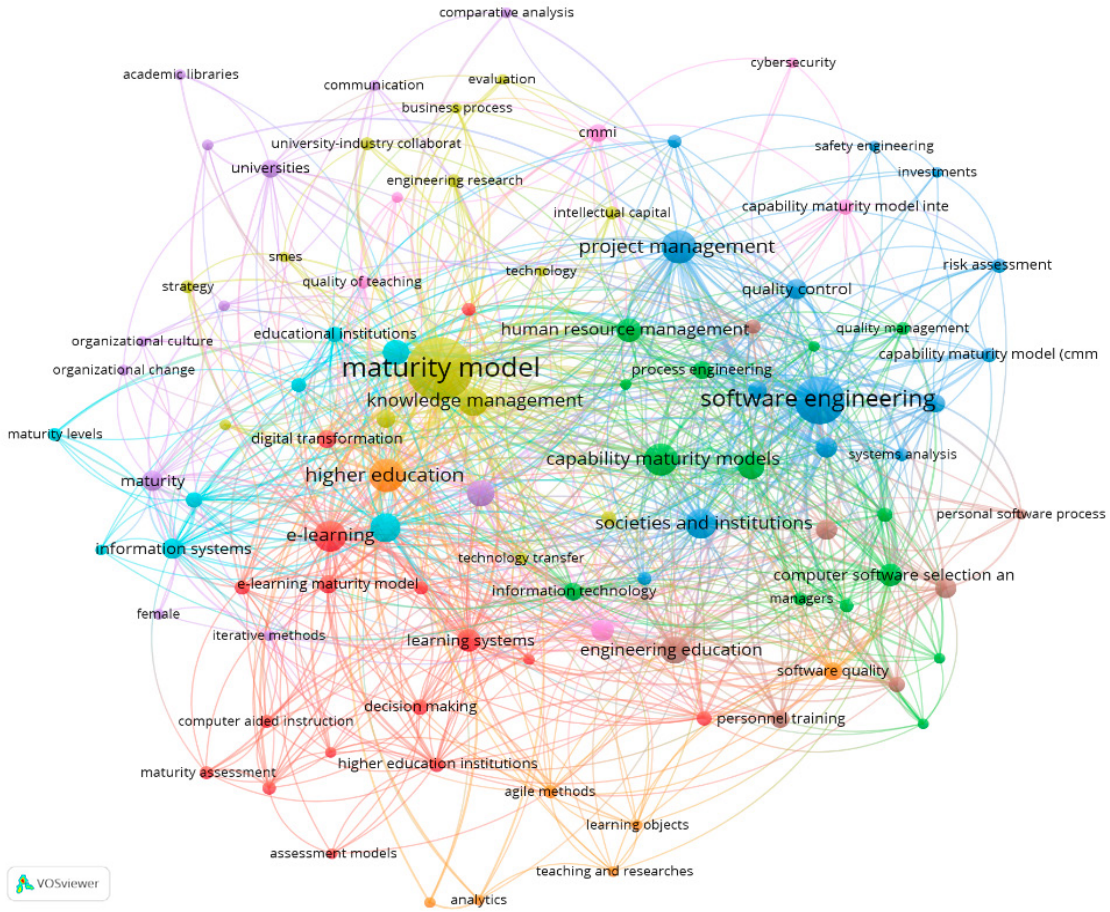

Figure 3. Keyword co-occurrence map of university maturity model

Source: authors' work using VOSviewer software.

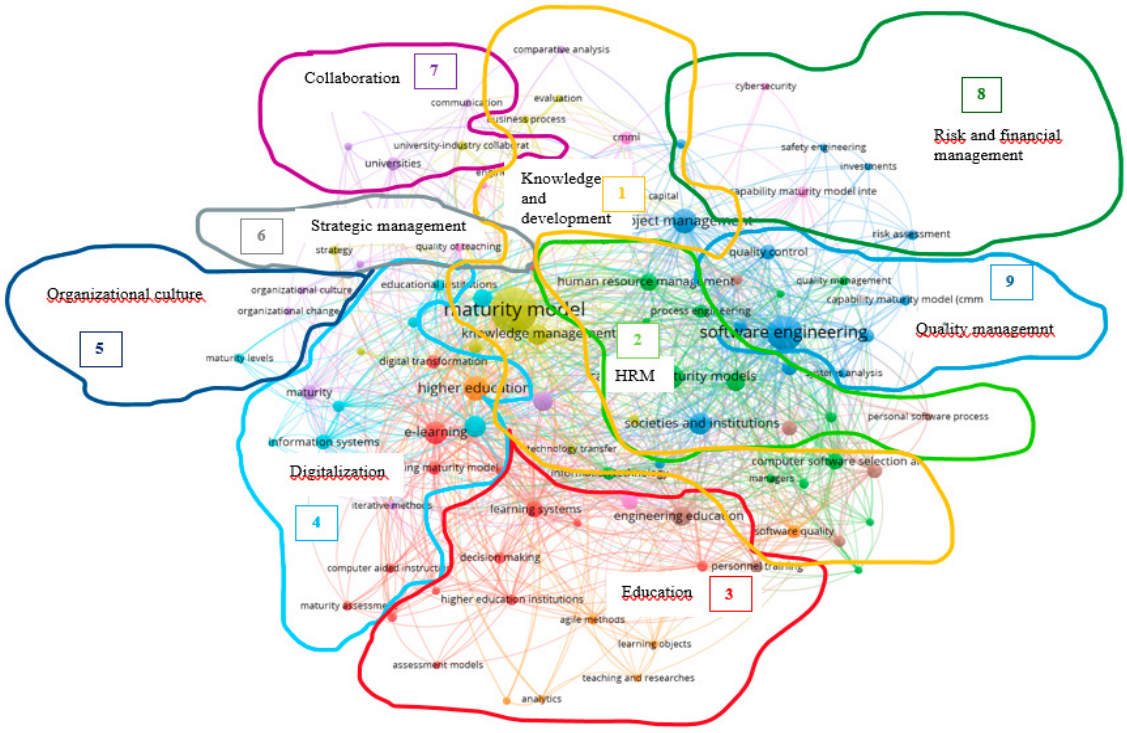

Figure. 4. Thematic clusters of a university maturity model

The analysis generated nine clusters containing keywords (Table 3):

- yellow cluster: **knowledge and development** (e.g. Harin et al., 2024; Korzeb et al., 2024; Alghail et al., 2017, 2022, 2023; Ilker Murat et al., 2023; Peck, 2023; Cardoso & Su, 2022; Su & Cardoso, 2021; Edirisinghe et al., 2021; Rico-Bautista et al., 2022; Secundo et al., 2010, 2015, 2016, 2017, 2018; Frondizi et al., 2019; Katiliute & Daunoriene, 2015; Kitagawa & Lightowler, 2013; Pee & Kankanhalli, 2009; Dayan & Evans, 2006; Teah et al., 2006),
- green cluster: **HRM** (e.g. Behroozi & Khodadadi, 2017; Llamosa-Villalba et al., 2014; Kropsu-Vehkaperä & Kess, 2013; Pee & Kankanhalli, 2009),
- red cluster: **education** (e.g. Naim & Malik, 2023; Santally et al., 2020; Annan-Diab & Molinari, 2017),
- light blue cluster: **digitalization** (e.g. Kalender & Žilka, 2024; Paños-Castro et al., 2024; Acuna et al., 2024; Teichert, 2019; Jaico et al., 2019; Uhl & Gollenia, 2016; Bianchi & de Sousa, 2015),
- dark blue cluster: **organisational culture** (e.g. Aboramadan, 2021; Moreira et al., 2021; Dzimińska et al., 2020; Marshall, 2010),
- grey cluster: **staregy** (e.g. Szpilko & Ejdys, 2022; Kobylińska et al., 2024; Fowler, 2019; Heinemann & Uskov, 2018; Ganzarain & Errasti, 2016),
- purple cluster: **collaboration** (e.g. Silva et al., 2021; Frondizi et al., 2019; Awasthy et al., 2018; Othman & Omar, 2012),
- dark green cluster: **security and investments** (e.g. Moczydłowska et al., 2023; Miller et al., 2014; Sheen & Chung, 2011; Carcary, 2012),
- blue cluster: **quality** (e.g. Anthony & Antony, 2016, 2022; Painén-Paillalef et al., 2022; Maciąg, 2019; Dzimińska et al., 2018; Llamosa-Villalba & Méndez Aceros, 2010).

Table 3. Cluster names, keywords and generated factors in the university maturity modelling area

No.	Cluster name	Selected keywords	Factors that can influence the maturity of a university
1.	Knowledge and development	knowledge management, innovation, evaluation, engineering research, technology transfer, intellectual capital, capability maturity model, knowledge management maturity, sustainable development, innovations	• Opportunities for training and development • Level of knowledge transfer • Level of achievement of sustainable development goals • Involvement in technology transfer • Measures to conduct innovative research • Level of commercialization of research results
2.	Human Resource Management	human resource management, societies and institutions, managers, personal software process, leadership	• Leadership style • Ability to recruit, develop, and retain highly qualified academic and administrative staff • Distribution of roles and responsibilities • Transparency of regulations • Opportunities for advancement • Access to psychological support • Health protection
3.	Education	higher education, teaching, learning maturity model, interactive method, learning systems, agile methods, learning objects, personal training, quality of teaching, decision making, e-learning maturity model, students	• Quality of educational programs • Diversity of teaching methods • Opportunities for training and development • Level of innovation in teaching • Level of matching of programs of study to labour market needs • Student engagement
4.	Digitalization	digital transformation, information use, information systems, e-learning, maturity levels, computer-aided instruction, information technology	• Level of implementation of modern IT technologies • Level of implementation information management systems
5.	Organisational culture	organisational culture, behaviours, organisational change, management	• Atmosphere at the university • Level of alignment of personal and organisational values • Level of acceptance of the organisational structure • Level of understanding of the mission

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No.	Cluster name	Selected keywords	Factors that can influence the maturity of a university
6.	Strategic management	strategy, process, project management maturity	• Ability to plan long-term strategic development • Transparency in management • Capacity to respond to change • Ability to allocate resources efficiently • Level of engagement engage in regional development projects
7.	Collaboration	universities collaboration, university-industry collaboration, smes, international cooperation	• Cooperation with business • Cooperation with stakeholders • International cooperation • Cooperation between universities
8.	Risk and financial management	security, cybersecurity, risk assessment, safety engineering, investments, project management	• Effectiveness of risk management strategies • Sense of security
			• Measures to conduct innovative research • Ability to acquire projects • State policy on university funding • Possibility of obtaining external funding
9.	Quality management	quality control, process engineering, software engineering, cmm	• Organisation's image • Availability of modern laboratories, libraries, information technology and educational resources • Participation in national and international rankings • Obtaining accreditation from reputable institutions assessing the level of education and research • Level of internationalisation

Source: authors' work using VOSviewer software.

Based on the literature review, factors influencing university maturity were generated (Figure 5).

Figure 5. Factors that can influence the maturity of a university

These factors should be subjected to expert evaluation in order to make a selection and determine their strength of influence and dependencies. On the basis of the data collected and the expert research carried out, a maturity model for universities can be created.

The University Maturity Model (UMM) can be built based on selected components that reflect the key areas of the university (Figure 6).

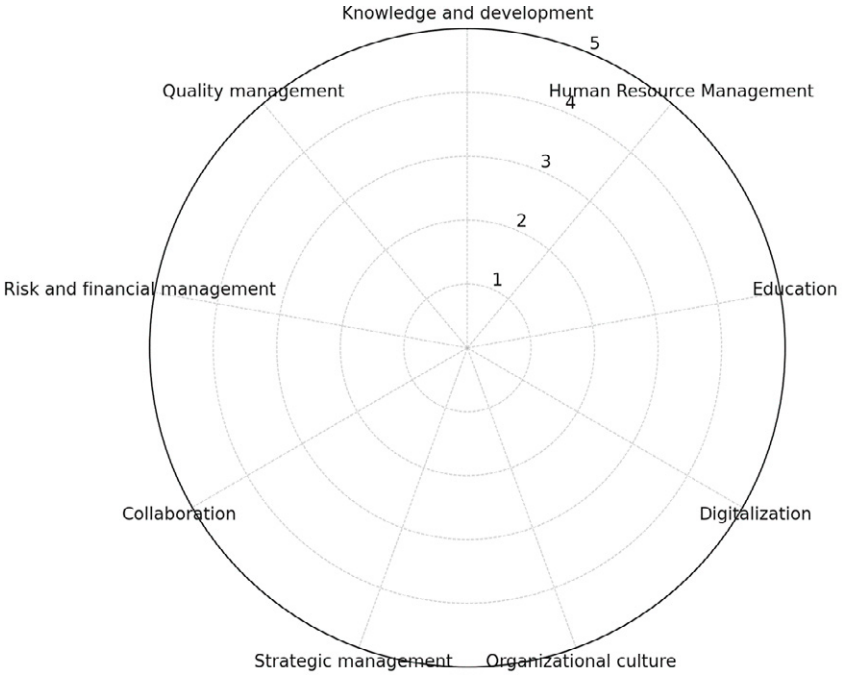

Figure 6. The University Maturity Model

Five levels of maturity can be used for each area. This model will help to assess how well the university is performing in certain aspects and identify areas that need further development.

Example levels and how they fit into the different areas are presented below. It should be emphasised that this is only a preliminary proposal, which should be subject to expert evaluation.

Maturity Levels:

- Level 1: Initial (Ad hoc) – Processes and actions are reactive, often based on random decisions. There are no defined procedures or strategies.
- Level 2: Structured (Repeatable) – Processes begin to be structured, but they are still managed informally. Basic procedures start to emerge, but their implementation is inconsistent.
- Level 3: Standardized (Defined) – Actions and procedures are formally established, and processes are repeatable and documented. Systematic oversight of process implementation starts to appear.
- Level 4: Optimized – Processes are continuously monitored and optimised. There are mechanisms for assessment and continuous improvement.
- Level 5: Innovative (Advanced) – The university actively pursues innovation and is a leader in its field. Processes are highly integrated and based on best practices.

Model Components:

Knowledge and Development:

- Level 1: No structured policy for research and development.
- Level 2: The university begins to develop research programs, but lacks a long-term strategy.
- Level 3: Well-defined research policy with regular participation in research projects.
- Level 4: The university actively collaborates with external partners and utilises research grants.
- Level 5: The university is a leader in innovation and research with global reach and activity.

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Human Resource Management:
- Level 1: No formal procedures for recruitment and staff development.
- Level 2: Basic recruitment and employee evaluation processes begin to emerge.
- Level 3: The university implements competency development programs and career paths.
- Level 4: Systematic employee performance evaluation and skills development.
- Level 5: The university promotes a culture of continuous development and innovation in HR management.

Education:
- Level 1: Traditional, lecture-based teaching approach.
- Level 2: The introduction of new teaching methods, such as project-based learning, begins.
- Level 3: The university introduces innovative teaching programs with a greater focus on interactivity.
- Level 4: Modern teaching approaches that integrate digital technologies.
- Level 5: Personalized learning paths with full integration of digital technologies.

Digitalisation:
- Level 1: No structured approach to digitalisation.
- Level 2: Initial attempts to implement digital solutions, such as e-learning.
- Level 3: Digital systems support educational and administrative processes.
- Level 4: Digitalization encompasses all aspects of university operations, from education to management.
- Level 5: The university is a digital leader with advanced systems based on AI and data analytics.

Organzational Culture:
- Level 1: Ad hoc and fragmented culture, values are inconsistent, communication is dispersed, and employee engagement is low. There is a lack of shared vision and identity.
- Level 2: Emerging cultural framework, employee engagement begins to develop, but the sense of belonging is limited to certain groups.
- Level 3: Defined and shared culture, established values are widely accepted. Collaboration and engagement among employees and students are strengthened.
- Level 4: Strong, adaptive culture, high levels of engagement and collaboration. Values are integrated into daily operations.
- Level 5: Dynamic culture promoting innovation, inclusivity, and continuous improvement.

Strategic Management:
- Level 1: No long-term strategy, actions are taken ad hoc.
- Level 2: The strategy is developed but implemented in a limited capacity.
- Level 3: The strategy is systematically implemented, and its effects are monitored.
- Level 4: Regular strategy reviews and adaptation to changing conditions.
- Level 5: The university proactively responds to changes in the environment and shapes future trends.

Collaboration with External Stakeholders:
- Level 1: No regular contact with external stakeholders.
- Level 2: First contacts with external partners are being established.
- Level 3: Collaboration with external stakeholders is formalised.
- Level 4: Active partnerships with businesses and external organisations, participation in international projects.
- Level 5: The university is a key partner for various external stakeholders and a leader in international collaboration.

Risk and Financial Management:
- Level 1: No formal risk and financial management in place.
- Level 2: The university starts to introduce basic risk management and budgeting mechanisms.

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- Level 3: The university applies formal financial management processes and budget monitoring.
- Level 4: Effective risk and financial management with the use of advanced analytical tools.
- Level 5: The university has innovative risk and financial management mechanisms, allowing it to respond quickly to changing market conditions.

Quality Management:

- Level 1: No systematic quality management.
- Level 2: Initial steps towards quality management, but no formalised processes.
- Level 3: Implementation of a quality management system based on standards and procedures.
- Level 4: Regular quality assessment and implementation of corrective actions.
- Level 5: A comprehensive quality management system where the university continuously raises its standards.

The University Maturity Model (UMM) allows for the assessment of development levels in each key area and helps identify needs for further development. It can be used for internal audits, strategy development, and as a benchmarking tool in comparison to other universities.

The University Maturity Model (UMM) provides a structured framework for assessing a university's development across multiple core areas, facilitating internal evaluations and strategic planning. It classifies progress into five distinct levels, ranging from reactive, ad hoc practices (Level 1) to highly innovative, integrated processes (Level 5). Each area of university operation, such as Knowledge and Development, Human Resource Management, Education, and Digitalization, is evaluated according to these maturity levels, with corresponding criteria to assess the sophistication and integration of processes. For instance, in Knowledge and Development, a university at Level 1 lacks a structured policy for research, whereas at Level 5, it leads in global innovation and research activities. Similarly, Digitalization progresses from rudimentary attempts at implementing digital solutions (Level 2) to fully integrated, AI-driven systems (Level 5). These examples highlight how the model captures both the evolution of organisational structures and the university's ability to innovate.

A critical aspect of UMM is its capacity to identify areas requiring further growth by evaluating each domain individually, supporting both long-term planning and comparative benchmarking with peer institutions. However, as emphasised, this model remains a preliminary proposal that requires expert evaluation and refinement to ensure its effectiveness in various educational and operational contexts.

Limitation and future research

The research was limited to the use of Scopus and Web of Science databases, excluding other databases like Google Scholar or national repositories, which may contain relevant publications. The analysis only included articles published in English. Studies in other languages that might provide valuable insights were not considered, potentially introducing a language bias.

The theoretical University Maturity Model (UMM) proposed in the study has not yet undergone expert validation. As a result, its applicability and accuracy in different educational and operational contexts remain to be confirmed.

Future research should focus on validating the theoretical University Maturity Model through consultations with experts from various fields. This could involve both internal stakeholders (academic staff, administration) and external ones (business partners, policymakers).

Research could focus on comparing the maturity levels of universities in different regions of the world, taking into account local contexts and specific educational challenges. Such a global review would provide a better understanding of the diversity of needs and strategies.

It would be beneficial to investigate how the level of university maturity correlates with educational, research, and social outcomes. Future studies could analyse the impact of organisational maturity on teaching quality, research results, and international cooperation.

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Conclusions

In today's fast-evolving educational landscape, universities face growing pressures to assess and optimise their processes. Maturity models have emerged as valuable tools for evaluating university operations across various dimensions, such as research, education, management, and technology transfer. These models provide a structured approach to analysing strengths, identifying areas for improvement, and developing strategies for growth.

The article explores various university maturity models. It emphasises that higher education institutions, despite their autonomy, face constant management challenges that can be addressed by using these models to systematise procedures and improve workflow efficiency.

A bibliometric analysis was conducted using databases such as Web of Science and Scopus, analysing publications that discuss maturity models in university contexts. The analysis revealed an increasing interest in the topic, particularly since 2008, with key themes emerging in areas such as knowledge management, digitalisation, human resource management, and quality control. Nine thematic clusters were identified, representing key factors influencing university maturity.

The generated factors in the context of university maturity are crucial for understanding how various aspects of academic operations can influence institutional development. In the maturity model, based on bibliometric analysis and existing models from the literature, several key areas have been identified (such as knowledge management, digitalisation, human resource management, education, strategic management, risk and financial management, collaboration with external stakeholders, and quality control), which together form a comprehensive structure for assessing the maturity of universities.

The process of creating a maturity model for universities was based on the gathered literature and conducted bibliometric research, which helped identify the most frequently mentioned factors and their impact on university operations. The aim of the model is to systematise the university's activities across various areas and allow for their evaluation on five maturity levels: from the initial (ad hoc) stage through structured, standardised, optimised, and finally, to advanced and innovative stages.

In this approach, the maturity model serves as a diagnostic tool, enabling the assessment of how well a university performs in various aspects of its operations. It also helps in setting development priorities, identifying weak points, and determining potential areas for improvement. Furthermore, such models can be employed to create quality management strategies and develop long-term development plans, which in turn enhances the university's competitiveness on the international stage.

Through this approach, universities can more effectively manage their resources and better respond to the needs of students, staff, and external stakeholders, such as businesses or research institutions. Ultimately, this model aims to support universities in their pursuit of academic and operational excellence.

Overall, the document underscores the importance of applying maturity models in higher education to foster continuous improvement and adaptability in a competitive and dynamic global environment.

The contribution of the authors

Conceptualisation, J.S., A.S., and F.DP.; literature review, A.S.; methodology, J.S.; formal analysis, J.S.; writing, J.S. and A.S.; conclusions, J.S., A.S. and F.DP.

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MODEL DOJRZAŁOŚCI UCZELNI – ANALIZA BIBLIOMETRYCZNA

STRESZCZENIE: We współczesnym dynamicznym i konkurencyjnym środowisku uniwersytety odgrywają kluczową rolę w generowaniu, przekazywaniu i zastosowaniu wiedzy oraz innowacji. Rosnące zainteresowanie oceną funkcjonowania uniwersytetów na poziomie krajowym i międzynarodowym doprowadziło do rozwoju i zastosowania modeli dojrzałości uczelni jako skutecznych narzędzi oceny. Celem artykułu jest przedstawienie różnych podejść do modelowania dojrzałości uczelni. Zastosowano analizę bibliometryczną. Wykorzystano publikacje dostępne w bazach Web of Science i Scopus. Objęto nią teksty zawierające frazy („maturity model" i universit*) w temacie oraz w tytule, abstrakcie i słowach kluczowych. Zapytanie badawcze obejmowało TITLE-ABS-KEY („maturity model" and universit*) dla bazy Scopus oraz TS = („maturity model" and universit*) dla bazy Web of Sciences. Przeszukano materiały opublikowane w latach 1994-2024 w języku angielskim. Do ostatecznej analizy wybrano 123 publikacje. Na podstawie przeglądu literatury zidentyfikowano kluczowe czynniki, które mogą wpływać na dojrzałość uniwersytetów w dziewięciu obszarach. Przedstawiono również teoretyczny model dojrzałości uczelni, który w kolejnych etapach powinien zostać poddany ocenie ekspertów. Wyniki sugerują, że zastosowanie modeli dojrzałości może znacznie poprawić zarządzanie i efektywność operacyjną uniwersytetów, oferując cenne informacje dla decydentów w formułowaniu polityki edukacyjnej.

SŁOWA KLUCZOWE: model dojrzałości, uczelnie

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