Journal of
Information Systems Engineering
and Business Intelligence

Vol.10, No.2, June 2024
Available online at: http://e-journal.unair.ac.id/index.php/JISEBI

Motivations and Potential Solutions in Developing a Knowledge Management System for Organization at Higher Education: A Systematic Literature Review

Nandhita Zefania Maharani [1)*], Shabrina Salsabila Kurniawan [2)], Dana Indra Sensuse [3)], Imairi Eitiveni [4)], Deden Sumirat Hidayat [5)], Erisva Hakiki Purwaningsih [6)]

[1)2)3)4)5)6)] *Faculty of Computer Science, Universitas Indonesia, Depok, Indonesia*

[1)]nandhita.zefania@ui.ac.id, [2)]shabrina.salsabila01@ui.ac.id, [3)]dana@cs.ui.ac.id, [4)]imairi@cs.ui.ac.id, [5)]dede025@brin.go.id, [6)]erisvaha.kiki@ui.ac.id,

[5)] *National Research and Innovation Agency (BRIN), Central Jakarta, Indonesia*

[5)] dede025@brin.go.id

Abstract

Background: Amidst a rapidly evolving digital landscape that accelerates the flow of information, higher education institutions face the unique challenge of managing vast and dynamic knowledge resources. This research delves into the motivations and innovative solutions for developing Knowledge Management Systems (KMS), which is key to optimizing knowledge resource utilization and enhancing academic collaboration.
Objective: This research provides a comprehensive mapping of problems and solutions for developing university knowledge management systems based on previous research. Not only that, but the results of this study also suggest three future research studies that can be adopted.
Methods: This study used the Kitchenham systematic literature review method. The author uses literature in the form of journals and conference proceedings published from 2019 to 2023. Twenty-three articles were used for this study from 5 databases, such as ACM, ProQuest, Scopus, Taylor & Francis, and IEEE Xplore.
Results: This study reveals research trends in knowledge management systems within higher education, examining aspects such as country, data collection methods, research methodologies, and theoretical frameworks. The main problems motivating the development of KMS are identified and categorized based on the people, process, and technology framework. In overcoming these problems in the university business process, there are several alternative solutions, both in the form of requirements and systems. Thus, the results of this study seek to provide guidelines for future research to adopt alternative solutions from this research and develop KMS to provide new solutions.
Conclusion: This study advances knowledge about various trends, motivations, requirements, and system solutions to address KMS problems in higher education. The authors' research results can add valuable insights to improve our understanding of the development of KMS in universities in various countries. Future research can identify new potential in KMS in business processes currently running in a university with appropriate methodologies.

Keywords: Knowledge management system, higher education, systematic literature review, problem, solution

Article history: Received 9 February 2024, first decision 31 May 2024, accepted 25 June 2024, available online 28 June 2024

I. INTRODUCTION

There are various organizations under the auspices of higher education or universities, both student organizations and organizations in the formal structure of the university. When carrying out business processes in an organization, each member of the organization has specific knowledge in the area of responsibility. To keep this knowledge can be shared in the organizational environment, knowledge management is needed with a system that can support these activities. Knowledge management (KM) means knowledge management is an activity that maximizes scientific resources [1]. The primary process carried out in KM is creating, capturing, correcting, storing, updating, and disseminating knowledge in the organization [2]. The information system that implements the KM process is the knowledge management system (KMS) [3]. This system is a forum for organizations to share knowledge within the

* Corresponding author

ISSN 2443-2555 (online) 2598-6333 (print)
doi: http://dx.doi.org/10.20473/jisebi.10.2.270-289

organization's scope. Therefore, the organization needs a KMS to support the process of sharing knowledge with other members.

The motivations for adopting knowledge management in higher education institutions stem from the need to efficiently preserve and transfer knowledge to society, with a growing interest worldwide in strengthening knowledge preservation strategies [4]. However, while technology transfer and knowledge sharing are recognized as critical components of innovation in higher education, the practical implementation and integration of KMS to support these processes remain underexplored [5]. There is a lack of comprehensive studies on the antecedents and effective mechanisms for knowledge sharing within higher education project teams, highlighting a gap in understanding how to leverage KMS to enhance team performance and reduce costs [6]. Furthermore, the applicability and impact of specific technology and KM tools in improving knowledge sharing and the learning experience in higher education have been insufficiently investigated, particularly in the context of developing countries [7]. The evolving nature of KM processes in the era of Industry 4.0 presents an opportunity for higher education to adopt new methodologies and tools. Yet, there is limited research on how these advancements can be effectively integrated into KMS for educational organizations [7]. Lastly, the role of social media and other digital platforms in facilitating knowledge transfer and supporting collaborative learning in higher education has been acknowledged. However, the development of frameworks to effectively integrate these tools into KMS is still in its nascent stages [8].

Previous research has been conducted to identify the implementation of KMS in higher education. However, these studies focused on the main problems, targeting one or two issues. Previous research focused more on benefits and challenges [9], trends [10], gamification implementation [11], drivers of KMS adoption [12], and system integration [13]. Another research identified the impact of cloud use integrated with KMS to support knowledge management in higher education [9]. Other research summarises Information and Communication Technology (ICT) development trends in KMS implementation in higher education in different regions [10]. A further study used gamification in KMS to increase participation in research [11] and integrated KMS with e-learning systems for blended learning [13]. In addition, other studies have identified factors that influence people to adopt KMS in higher education to increase effectiveness and productivity [12]. Therefore, this research seeks to discover the issues that motivate the development of KMS in higher education and then map them to appropriate feature recommendations.

This systematic literature review explored various motivations, problems, and challenges encountered in developing KMS in university organizations, guided by the People, Process, Technology (PPT) framework [14]. The PPT framework is a holistic approach emphasizing the interdependence and alignment of three critical organizational components: people, process, and technology. This framework ensures that technology implementation is effectively integrated and supported by appropriate processes and human resources, enhancing organizational performance and efficiency [15,16]. People refers to the individuals or teams involved who must have the necessary skills and knowledge to utilize technology effectively [15]. Process encompasses the structured series of actions or steps to achieve specific goals, ensuring consistency and optimization across various operations [15]. Technology includes the tools, systems, and software that facilitate and streamline these processes [15].

The application of the PPT framework is crucial as it provides a comprehensive approach to addressing organizational challenges and achieving strategic objectives [14]. Therefore, this study employs the PPT framework to systematically map problems and solution requirements for developing a KMS in higher education. By mapping based on people, process, and technology aspects, higher education institutions can ensure a balanced and synergistic approach to change management and innovation. This alignment helps mitigate risks associated with technology adoption, such as resistance to change or process inefficiencies [16]. Additionally, the framework helps identify gaps and potential areas for improvement, thereby facilitating the development of a robust and effective KMS that aligns with higher education goals and enhances overall performance.

This research aims to learn more about the development of KMS for organizations in universities in the future. The research adopts the Kitchenham methodology as a guide for conducting a Systematic Literature Review (SLR) to provide a comprehensive and in-depth overview of the existing literature, identify research gaps, and offer evidence for best practices. The author will use this literature review in future research related to KMS development to overcome problems in university organizational business processes. Therefore, the author needs a SLR to find various problems and solutions implemented in developing KMS in previous research. Behind this application, of course, there are various motivations, problems, and proposed solutions to problems encountered in developing KMS in universities. These things need to be known further so that the development of KMS can be planned. Through this literature review, subsequent research is expected to find out how the implementation of KMS is following existing problems in the organization through proposed solutions that are right on target. This is the main reason for implementing SLR regarding KMS, which has been developed in higher education organizations over the past five years. Therefore, through the results of this SLR, researchers can find the best practices for solving organizational problems based on previous research and the methodology used to develop KMS.

II. LITERATURE REVIEW

A. Knowledge Management in Higher Education

Various types of KMS have been applied in organizations to share knowledge, especially those under the auspices of higher education. These organizations include faculties, counseling institutions, research laboratories, and teaching assistant institutions. Each of these organizations has different business processes. However, various challenges are faced in carrying out these business processes. For example, counseling agencies in universities in the Philippines still manually collect data on counseling students, so updating the data is difficult [17]. Then, there is still an effective way to share knowledge related to practical teaching between university teachers. The goal is that knowledge related to practicals is not lost and can be applied occasionally [18]. There needs to be a system to deal with the problem.

Most of the problems experienced by business processes in university organizations are creating, capturing, correcting, storing, updating, and disseminating knowledge that is still done traditionally. The KMS is a solution to overcome these challenges. According to the definition of KMS in the previous explanation, KMS can make sharing knowledge more efficient through the systems that operate in it. Using KMS helps organizations correct existing errors by evaluating old knowledge [19] and systematically identifying, using, and transmitting scientific information [20]. Therefore, many studies have examined the development of KMS to deal with challenges in organizational business processes in universities.

B. People-process-technology (PPT) framework

The PPT framework was first developed by Schneier [14] as an extension of Leavitt's Diamond Model; the elements in this model consist of people, structure, tasks, and technology. The model illustrates the interconnectedness between essential organizational elements when facing a change. Schneier [14] developed the model by combining structure and task elements into a new process element. Then, a new framework called people-process-technology was formed. The framework emphasizes that the organization's balance of people, processes, and technology determines success and efficiency in the organization's business processes when facing a change. The PPT framework is generally used to investigate various organizational management issues, including implementing knowledge management. The PPT framework has a theoretical foundation that helps investigate problems in implementing knowledge management in organizations [14].

1) People

The people element refers to people who use KMS in organizations. In this use, people share knowledge based on specific interests and beliefs. When people believe and are willing to share their knowledge, they can succeed in using knowledge management in organizations [15,21]. Therefore, people have the most crucial role in knowledge management [15].

2) Process

The process element refers to sharing knowledge and learning using knowledge management [21]. It takes implementing infrastructure such as hardware, software, and networks to support the processes that occur using knowledge management [22]. In higher education, knowledge management includes how organizations acquire, create, and organize knowledge in higher education [15]. It aims to train the ability of members of educational institutions so that they can achieve the desired business processes.

3) Technology

Technology refers to the efficiency of infrastructure that works on a KMS. A good infrastructure integrates scientific information effectively and efficiently into the KMS [22]. Examples of technology elements include the implementation of cloud computing in KMS, which is considered to make KMS more effective and efficient and can reduce expenditure costs [23]. This shows that applying the proper infrastructure in the KMS affects its performance.

C. Related Secondary Studies

Secondary studies have also examined the implementation of KMS in higher education. Each of these studies focuses on the goals and context set. Previous studies discussed the benefits and challenges of integrating KMS with the cloud [9], identifying trends of ICT in KMS implementation [10], developing a gamification model for KMS [11], finding factors that increase KMS adoption [12], also the integration process of KMS and e-learning system in higher education [13]. The summary of the research is summarised in Table 1.

Noor et al. [9] discussed cloud-based KMS in Higher Education Institutions (HEIs) to identify the benefits and challenges associated with these systems. By exploring previous literature, this research seeks to understand the impact of cloud-based KMS on knowledge dissemination and education in higher education. The research results are expected to provide insights into how cloud-based knowledge management systems can enhance knowledge creation, sharing, and decision-making processes in higher education settings.

Yigzaw et al. [10] examined the ICT integration trend in KMS within higher education institutions. This study emphasizes the crucial role of technology in managing and enhancing the distribution and utilization of KMS, identifying significant gaps, and providing specific insights for the education sector in developing countries. The findings reveal that although ICT significantly promotes sustainability in education and research, challenges in adopting KMS in less developed regions remain.

Sanmorino et al. [11] emphasize that the conventional KMS used in higher education institutions do not adequately optimize research outcomes, prompting them to explore gamification as an additional approach. Through a detailed literature review, they identified a significant gap in the application of gamification within the existing KMS frameworks, leading to the conceptualization of an enhanced KMS model incorporating game-like elements to foster greater engagement and productivity among researchers. Their findings suggest that integrating gamification can substantially transform the traditional research management approach, making it more dynamic and effective in promoting collaboration and enhancing outputs in academic settings.

Abdullah et al. [12] identified the benefits of implementing KMS to address unproductive information management and enhance the institution's overall performance. This study aims to provide an in-depth review of the influential factors in the decision-making process for adopting or rejecting KMS. The results of this study have developed and proposed a comprehensive, integrated conceptual model for KMS implementation aimed at enhancing the performance and efficiency of higher education.

Samar Ibrahim et al. [13] explored the integration of KM processes in higher education, focusing on using KMS to facilitate a blended learning environment. Their findings reveal that although KM significantly boosts innovation and organizational performance, the deployment of KMS often falls short of expectations, hindered by underutilization and ineffective strategic alliances within institutions. They underscore that effectively implemented KMS can revolutionize traditional learning environments into dynamic and adaptable educational spaces, though substantial challenges persist in maximizing the system's effectiveness in higher education.

There is a clear focus on the purpose and context of the above studies. Each of the studies focuses on a specific KMS implementation, such as the adoption of cloud computing [9], ICT trends [10], the adoption of gamification [11], the factors influencing the adoption of KMS [12], and the integration with e-learning systems [13]. The previous studies identified one or two problems and then provided recommendations for requirements and feature solutions for KMS in higher education. However, none of them have further explored the various problems found in higher education as a motivation to develop a KMS, especially providing proposed features and requirement solutions to overcome these problems.

TABLE 1
RELATED STUDIES

Ref	Goal	Concerns in research questions
[9]	Present the benefits and challenges of implementing cloud-based knowledge management in higher education.	A. Exploring the key benefits and challenges of integrating Knowledge Management Systems (KMS) with cloud computing in higher education.
[10]	Exploring the state-of-the-art and trends in the application of implementation of KMS within higher education	A. Examining the evolving roles of technology within higher education knowledge management systems. B. Assessing ICT's impact and changing significance in KMS applications in higher education.
[11]	Propose a novel KMS model that incorporates gamification elements to enhance its effectiveness.	A. Investigating whether incorporating gamification elements into the KMS model enhances research productivity. B. Determining if gamification boosts researcher motivation to maximize research output.
[12]	Develop a comprehensive, integrated conceptual model for implementing KMS in higher education that leverages technology to elevate performance.	A. Analyzing the factors influencing the implementation of KMS in educational institutions. B. Categorizing the influencing factors of KMS implementation into technology, organizational, and environmental levels.
[13]	Summarize the integration of KMS processes within a blended learning framework in higher education to drive innovation and enhance performance.	A. Evaluating the main KM processes implemented in higher education and their impacts. B. Mapping the geographical distribution of KM research across various countries. C. Identifying primary research methods and databases used in KM studies. D. Exploring the relationship between KM processes and innovation in higher education. E. Examining the effects of blended learning environments with KMS on academic performance in higher education. F. Developing a framework for implementing KMS in more blended learning environments within higher education institutions.

III. METHODS

This study used the appropriate Kitchenham SLR method to answer the research questions consisting of three phases of SLR as a guide: planning, conducting, and reporting [24,25]. This approach is also expected to provide a comprehensive overview of the existing literature, identify research gaps, and furnish evidence for best practices. During the reporting phase, the author will present the final results of the systematic literature review as a research report. Meanwhile, a detailed description of the planning, conducting, and reporting phases will be shown below.

A. Planning Phase

The first phase is planning to identify SLR needs and determine protocol review. The purpose of implementing this SLR is to discover the problems and solutions in developing KMS in higher education organizations. Thus, this SLR needs to collect various problems that become motivations in the development of KMS and map them to proposed solutions to overcome these problems in the organization's business processes. Furthermore, the review protocol is determined using the PICOC formula, which consists of population, intervention, comparison, outcomes, and context. Details for the PICOC formula are explained in Table 2.

TABLE 2
PICOC FORMULA

Description	Criteria
Population	Knowledge management system in higher education
Intervention	Problems and solutions for developing KMS in higher education
Comparison	N/A
Outcome	List of problems and solutions for developing a KMS in higher education
Context	Organizations in higher education that use KMS to solve problems in their business process

The research questions in this study are developed using the PICOC framework, ensuring precise targeting of specific insights relevant to the defined aspects of the study. These questions guide the selection of relevant papers, inform the data extraction methods, and drive the synthesis of findings. This structured approach anchors the systematic literature review process, providing a clear pathway from question formulation to data analysis. There are three research questions (RQ) for this study consisting of:

RQ1. How is the trend of knowledge management systems implementation in higher education?

RQ2. What problems motivate the development of a knowledge management system in the organization domain at higher education?

RQ3. What proposed solutions for problems were discussed in the previous paper?

B. Conducting Phase

Implementation includes research identification, literature selection, quality testing, data extraction, and data synthesis. In research identification, the authors conducted a literature search on several databases, such as Scopus, IEEE Explore, ACM Digital Library, ProQuest, and Taylor & Francis. The search in the database is carried out using keywords in the form of boolean AND and OR as follows:

("knowledge management system") AND ("higher education" OR "college" OR "university" OR "academic") AND ("motivation" OR "problem" OR "issue" OR "challenge" OR "solution")

Search with these keywords is devoted to titles, keywords, or abstracts in previous research published in the database. Then, the literature search results are stored on Mendeley as reference management software. Furthermore, the author selects based on inclusion and exclusion criteria tailored to the research objectives in Table 3.

TABLE 3
INCLUSION AND EXCLUSION CRITERIA

Stages	Inclusion Criteria	Exclusion Criteria
Initiation Stage	Journal publications and conferences; Published between 2019 and 2023;	In addition to journal publications and conferences; Not published between 2019 and 2023
Stage 1 (Title and abstract selection)	There are keywords related to knowledge management systems in higher education; Discuss motivations, problems, and solutions related to the application of knowledge management systems	There are no keywords related to knowledge management systems in higher education; Does not discuss motivations, problems, or solutions for applying knowledge management systems.
Stage 2 (Full-Text Selection)	Can answer research questions, namely discussing motivations, problems, and solutions in the application of knowledge management; Passed the minimum score in the quality test	Not answering research questions, which do not discuss motivations, problems, and solutions to the application of knowledge management; Failed to pass the minimum score in the quality test

The author only uses papers published in the last five years (from 2019 to 2023) to ensure the papers are up-to-date with the latest technology and systems. Furthermore, paper selection will be carried out in several stages, starting from the first stage, namely the search stage from the database with the results of 309 papers. Then, in the second stage, the author eliminated 198 papers based on inclusion and exclusion criteria and obtained 111 selected papers. Furthermore, in the third stage, the author checked for duplicate papers and confirmed there were no overlaps, resulting in a total of 111 unique papers being obtained. In the fourth stage, the author conducted a full-text check with a quality assessment and selected 23 papers as the final result to be used in data extraction. Visualization of the final literature selection process can be seen in Fig. 1.

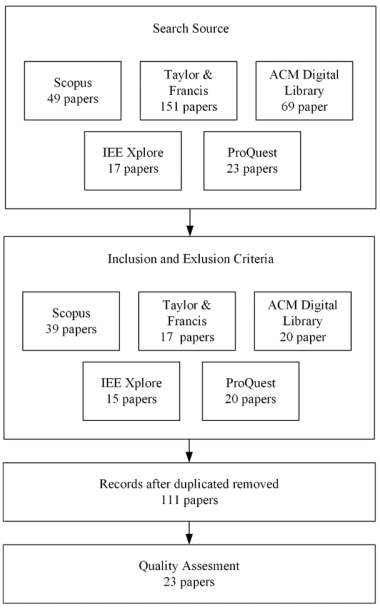

Fig. 1 Final literature selection process

At the quality assessment stage, the author will test the papers obtained before. This is done to evaluate the suitability and quality of the context of this study. This quality check includes research objectives, previous research, methodology, results, conclusions, objectives, and literature indexes. Index identification is done by checking on Scimago Journal & Country Ranks. The author uses an assessment with a score of 0 to 1 based on the questions in Table 4. A score of 0 indicates that the study does not meet the predefined checklist criteria, and a score of 1 indicates that the study is highly consistent with the checklist criteria [26].

A minimum score of 5 is required to qualify a paper for final selection, following the guidelines adopted from studies[26,27]. This threshold is set based on a checklist of eight criteria, with a score of five signifying that the paper meets more than half of these standards [28]. Furthermore, this scoring criterion is established to enhance the findings' reliability, integrity, and validity, thus ensuring that the research results and evidence are trustworthy [26,29]. Therefore, the results of this assessment obtained 23 final papers.

TABLE 4
LITERATURE QUALITY TEST QUESTIONS

Checklist	Question Checklist
C1	Does the article describe the purpose of the research clearly?
C2	Does the article write a literature review, background, and research context?
C3	Does the article feature related work from previous research to show the study's main contribution?
C4	Does the article describe the proposed architecture, methodology, or research method?
C5	Does the article have research results?
C6	Does the article present conclusions that are relevant to the purpose/problem of the research?
C7	Does the article recommend future work or improvements that fit the SLR context?
C8	Does the article Scopus indexed (Q1/Q2/Q3/Q4/unindexed)?

After getting the final paper, the author extracts and synthesizes data. At the data extraction stage, the author will store information from each final paper obtained. The extraction of such data includes the underlying problems and motivations of the research, the solutions proposed in the study, and the systems developed. In addition, the author also extracts methodologies and theories from previous research as consideration for choosing methodologies and theories to be used for future research. Other data extractions that the author also carried out were data collection methods, country context, target users, and limitations from previous studies that have the potential to be developed in future studies.

Data extraction was conducted using a specified form outlined in Table 5 to gather information essential to our research question. This method ensured the comprehensive documentation of all primary studies relevant to the inquiry. Through this approach, thorough data collection and analysis were achieved.

TABLE 5
DATA EXTRACTION FORM

No.	Study Data	Description	Relevant RQ
1	Identifier	Unique ID for the study	Study overview
2	Title		Study overview
3	Authors		Study overview
4	Year		Study overview
5	Type of Article	Journal, conference	Study overview
6	Research goal	What are the main objectives or aims of this study?	1, 2, 3
7	Background	What is the background or context of this study?	1, 2, 3
8	Country	Which country served as the location for the research study?	1, 2
9	Research method	What research methods were used in this study?	1
10	Data	What kind of data was collected in this study?	1
11	Problem and motivation	What are the problems addressed by the study and its underlying motivations to develop KMS?	2, 3
12	Solution	What KMS feature solutions are proposed or developed in the study?	2, 3
13	Developed system	What is the name or type of the KMS solution developed in this study?	2, 3
14	Validation	What methods were employed to validate the findings of this study?	1, 2, 3
15	Limitations and future research	What limitations and future research has the study acknowledged?	2, 3

In synthesizing data, the author maps every problem and solution found in previous research in KMS development based on the people-process-technology framework. This framework was chosen as a guideline in classifying the author's data extraction results because it can help investigate various problems in implementing technology in organizations, including KMS. The author also attempts to classify similar problems and solutions. At this stage of data synthesis, the author will also display the results of the methodology and theory obtained to see the methodology and theory often used in previous research. Then, the author will also explain some problems that are usually the background of the study as well as solutions and systems developed according to the data extraction results.

C. Reporting Phase

The review articulated its findings by summarizing research studies and responding to each designated RQ based on the data gathered. Essential issues in the SLR were identified and reported using the PRISMA Checklist [30,31] as a guideline. This approach ensured a thorough and structured presentation of the review's outcomes.

IV. RESULTS

In this section, the author will answer the research questions asked. The author made a table that includes problems and solutions from previous research to answer these two research questions. Then, the author divides the solution into solutions for requirements and system solutions developed from previous research. After addressing the research questions, the authors also provide recommendations for future research based on the analysis following the resolution of the research questions. The recommended future research takes the form of proposed ideas for new research based on the novelty of the research context and the urgency of investigating areas not explored in the literature analyzed by the authors.

Based on the quality assessment (Table 4) conducted, all primary studies (23 articles) were evaluated. The first question (C1) assessed the clarity with which each study described its research purpose, with 87% of the studies affirming clear research objectives. The second question (C2) evaluated whether the studies provided a comprehensive background and literature review, receiving a positive response in 52% of studies. The third question (C3) inquired if studies effectively demonstrated their contribution through related work, which 74% successfully showcased. The fourth question (C4) focused on the comprehensiveness of methodology descriptions, with 61% providing thorough

details. The fifth question (C5) concerned the clarity and presentation of research results, achieved effectively by 78% of the studies. The sixth question (C6) evaluated the relevance of the conclusions to the research problem, adequately addressed in only 61% of the studies, indicating a potential area for improvement. The seventh question (C7) asked whether the studies suggested future work or improvements appropriate for the systematic literature review context, affirmed by 87% of the studies. Lastly, the eighth question (C8) checked for Scopus indexing to measure recognition and impact, showing that 96% of the articles were indexed. Fig. 2 presents the percentage results of quality assessment for all primary studies.

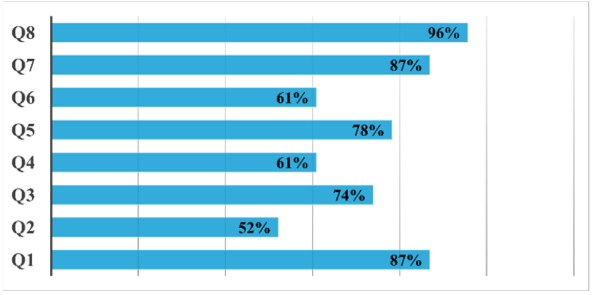

Fig. 2 Percentage Results of Quality Assessment

A. Trends KMS in Higher Education

The author obtained literature data based on the Kitchenham procedure carried out by the author for literature selection. The visualization of the extracted data from the 23 final papers obtained in the study is presented below.

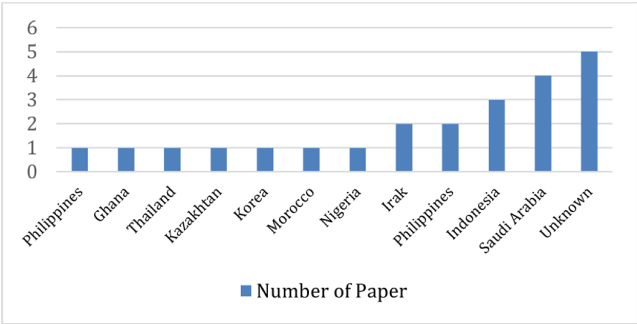

Fig. 3 Number of papers by country of origin

Based on the data extraction results conducted by the author regarding the number of papers based on their country of origin in Fig. 3, the author found that most papers use Saudi Arabia as a country context. Four kinds of literature discuss Saudi Arabia. One reason is that Saudia Arabia limits interaction between the opposite sex due to religious orders, so a KMS is needed so that differences in sex or gender do not hinder the learning process [32]

In other countries, such as Thailand [33], Nigeria [34], Morocco [35], Korea [19], Kazakhstan [20], Ghana [36], and the Philippines [17], research on KMS in universities is still limited because there is only one literature each that discusses the topic. Meanwhile, the five kinds of literature do not explain the context of the country in the study, so the author assumes that the process of collecting data and research results can be used in general.

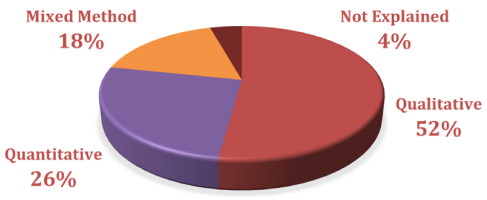

Fig. 4 Number of papers based on data collection method

Most data collection methods from previous studies used qualitative research, as many as 12 studies or more than 50%, as shown in Fig. 4. This was followed by data collection with quantitative analysis of as many as six pieces of

literature. There is also a mixed method for data collection, namely by integrating qualitative and quantitative research, as many as four studies. In addition, there was 1 study that did not explain the data collection method.

Research that uses qualitative methods gathers insights through interviews with relevant stakeholders who will use the developed system. The interviews were conducted with case studies [19], semi-structured interviews [32,37], experiments [20], usability testing [18], open-ended questions [38], open coding analysis [27], forum group discussion [39], and checklist questionnaires [40]. Qualitative methods are mostly carried out to collect the criteria needed in system development and evaluate the results so that most research resource persons with this method are stakeholders of system users. Then, research with quantitative methods, among others, is carried out using surveys [34,36], experiments [41], purposive sampling technique [42], and purposive judgment non-probability [43]. Quantitative methods are mostly used to analyze satisfaction factors from using KMS and evaluate the use of KMS, which results from research development.

Then, mixed-method research combined interviews and questionnaire distribution [44,45]. Interviews were conducted to collect user needs related to the system to be developed, then validated with descriptive analysis through questionnaire collection. Thus, each study uses qualitative and quantitative methods with different objectives according to research needs. However, several studies combine the two to provide more comprehensive research results.

TABLE 6
RESEARCH METHODOLOGY AND THEORY

Methodology and Theory	References	Number of Papers
Design Science Methodology	[32,37,46]	3
Waterfall Software Development Life Cycle	[33,39]	2
Joint application development (JAD)	[33,47]	2
Studio-Based Learning	[19]	1
Snowball Network	[41]	1
Carpe Diem Model	[38]	1
Moscow Rule	[47]	1
Kitchenham Systematic Literature Review	[27]	1
Rational Unified Process (RUP) Methodology	[40]	1
Axiomatic Design Theory (ADT)	[43]	1
Socio-Technical Theory	[36]	1
Bizagi Modeler	[35]	1
Fernandez Methodology	[47]	1
Feature-Driven Development (FDD) Agile Model	[43]	1

Based on Table 6, design science methodology is the most widely used methodology in developing KMS on 23 kinds of literature the author has identified. Furthermore, two papers implement waterfall as a guide in the software development life cycle and joint application development (JAD). In addition, some literature integrates several methodologies simultaneously to provide more comprehensive results. The combination of these methodologies includes JAD with Fernandez Methodology [47], JAD with SDLC [33], and axiom design theory (ADT) with feature-driven development (FDD) [43]. Meanwhile, nine kinds of literature do not explicitly mention the methodology and theory used as a research guide.

Design science methodology is a KMS development method consisting of three phases, namely problem identification, solution design, and evaluation [48]. Each phase is divided into several mutually continuous stages; these stages are not always carried out sequentially. The problem identification phase aims to find criteria for problems in the organization's business processes. The stages in this phase consist of identifying problems, literature research, expert reviews, and pre-evaluation of relevance. The output of this phase is the definition of research questions whose relevance has been validated by experts. Then, a state-of-the-art analysis of the identified problems was carried out. Furthermore, the solution design phase aims to develop solutions to problems identified in the previous stage. This phase consists of artifact design and literature research stages. Finally, the evaluation phase is carried out to evaluate the solution when it has reached adequate conditions. In this phase, it is possible to return to the stage of design artifact and identify problems. Evaluation can be done by conducting expert surveys, laboratory experiments, or case studies. Through these actions, an evaluation will be obtained to what extent the proposed solution has successfully dealt with the existing problem [48].

Almujally & Joy [32] use design science methodology in the development of the Teaching Practices Management System (TPMS) to apply an interesting approach to sharing knowledge related to Best Teaching Practices (BPT) in universities. The goal is for BPT to be well documented so that its knowledge can be passed on by academics further in providing teaching in universities. This research applies design science methodology to understand how university instructors share knowledge related to their teaching so that this method can be mapped into features in KMS. In the problem identification phase, this study interviewed 22 academics who worked at the universities to obtain functional

requirements. Then, the solution design phase is carried out by designing a system development design based on the BPT structure. There are three stages carried out in this phase. In the first stage, researchers conduct a literature review to find out the best practices of good documentation. The second stage is designing a medium-fidelity BTP Document Template prototype. The third stage is to refine the design of the previous stage by holding workshops attended by academics working in universities in Saudi Arabia. In the evaluation phase, design refinement was performed with the help of 30 academic participants from the Department of Computer Science at the University of Princess Nourah in Saudi Arabia [46]. The implementation of gamification in KMS also uses design science methodology for its development [37]. The problem identification stage is carried out by literature review and investigative studies by collecting university teaching instructors. Then, the solution design stage is carried out by making a design based on the requirements of the combination of results in the problem identification phase. Finally, the evaluation phase conducts experiments and analysis of the design results made in the previous stage [37].

Waterfall is one of the methodologies of the software development cycle (SDLC). This method comprises four phases: requirement analysis, design, coding implementation, testing, and maintenance. Previous research has used the waterfall to develop an expertise search system in KMS. The goal is to increase the use of KMS to improve the academic experience and help the branding of higher education institutions enhance public perception. The requirement analysis phase conducts forum discussions with lecturers, researchers, and experts in information systems, aiming to collect needs in building an expert search system. Then, in the design and coding implementation phase, make a low-fidelity prototype based on the requirements collected in the previous stage. Then, in the testing phase, the system development results are tested with the BlackBox testing [39]

Joint Application Development (JAD) design is a method by which users and developers work together to determine system development needs. The JAD phase consists of determining the objectives of the JAD session, collecting user requirements, preparing for the JAD session, implementing the JAD session, and producing a report in the form of a document containing aspects tested in the JAD session [47]. In previous research, JAD was used to develop KMS for the Institute of Assistant Lecturers at the Faculty of Computer Science University of Indonesia and organize tacit knowledge in universities in Thailand. Both literatures develop KMS by identifying the needs of the stakeholders concerned who will use the KMS.

B. Results of Problems and Solutions in KMS Development

The systematic literature review categorizes the problems identified in developing KMS using the PPT framework. The elements in this framework consist of essential components that are interrelated in the organizational business process, making it suitable for investigating issues in technology implementation in organizations such as KMS [14] The authors have classified the problems into people, technology, and processes. This classification is based on understanding each element, as the relevant theories section explains. The results of this classification are available in Table 7.

TABLE 7
PROBLEMS AND SOLUTIONS IN KMS DEVELOPMENT

Element	Problems	Requirement Solutions
People	User participation and motivation [32,37,47,49] Human aspect behavior [32,50] Need for collaboration [47]	Gamification [32,37,50] User's Feedback [32] User-friendly interface [40,47,50] Customer helpdesk [47] Communication tools [47] Issue management [47]
Process	Lesson learned [19,46] Knowledge sharing [18,23,33,34,37,40,46] Store Knowledge [18,32,34,40] Document access [19,47] Manual data search [17] Information limitations [41]	Best practice template [32,46] Documented knowledge [32,47] Knowledge from experts [50] Document management [19,47] Visual analytic report [17] Data search tool [18,20,40,50] Repository [35] Content categorisation [50] Recommendation [27,35] Article management [47]
Technology	Quality of Knowledge Management [40] Quality of education [35,43] Branding [39] Competitive advantage [39] Centralized system [40] Integrated data [20]	Security [40] Notification [50] Cloud computing [23] Centralized database [32]

Based on the grouping results, several problems were found in each element. The people element consists of three problems, the process element consists of 10 problems, and the technology element consists of two problems. Based on the number of problems in KMS development, they are most commonly found in process elements compared to other elements. This shows that paying attention to the process element in KMS development in higher education is very important because various problems occur, which is also in line with several previous studies [51–55]. Research by Oumran et al. [54] mentioned that identifying process elements can help facilitate and manage KM practices effectively in higher education. If the problem of the element process were identified as the background for the development of the KMS, more targeted feature recommendations and system innovations would be made [52,53]. Therefore, the process element is the most important because it can evaluate business processes' efficiency and identify improvement areas [51,55].

C. Results of Knowledge Management System Solutions

After mapping the problems and solution requirements, the author also created recommendations for various solutions in a system. This system's solution is derived from a previously successfully implemented system in prior research in higher education. The solutions in this research are distinguished into system and requirement solutions because solutions in the form of a system are more general and universal. These system solutions also combine several requirements, making it difficult to map with the problems in the previous table. The system solutions identified by the author during the data extraction phase are shown in Table 8.

TABLE 8
KNOWLEDGE MANAGEMENT SYSTEM SOLUTIONS

System Solutions	Reference
Studio based learning system	[19]
Research management system	[33]
Scholarly publication system	[27]
Document management system	[40]
Curriculum education management system	[43]
Teaching assistant knowledge management system	[47]
Teaching practices management system	[18,37,46]
Guidance and counseling support system	[17]
Knowledge ontological base system	[20]
Expert locator system	[41]
Expertise search system	[39]
Teaching experience management system	[32]
Knowledge management system quality management	[35]

V. DISCUSSION

A. Problems and Solutions in KMS Development

The people element consists of three problem topics, namely user participation and motivation [32,37,47,49], human aspect behavior [32,50], and the need for collaboration [47]. Problems around user participation and motivation include the lack of user motivation to carry out knowledge-sharing activities in KMS. Lack of motivation to share knowledge causes the knowledge-sharing process to be poor, resulting in low learning achievement. Teaching instructors are busy with their affairs, so sharing knowledge about teaching well for each course is challenging. This is due to their lack of motivation to share knowledge [56]. The lack of appreciation obtained by teaching instructors when sharing knowledge is also one of the causes of the lack of motivation in knowledge sharing [56]. Motivation is essential in implementing KMS [49,50]. Then, the problem with human aspect behavior includes a lack of user trust in sharing knowledge. This is due to their concern that they will lose intellectual property when sharing knowledge [32]. The quality of knowledge management depends on human aspects that have complete control in carrying out the management [49] Therefore, it can be concluded that the motivation of user participation and human aspect behavior are essential and need to be considered in the development and inspiration of KMS.

Almujally & Joy [37] implemented the Computer-based Teaching Practices Management System (TPMS) with a gamification approach to enhance motivation for participating in knowledge-sharing practices. High motivation among KMS users can encourage them to generate new ideas, learn, adopt new technologies, improve skills, and develop their abilities to achieve organizational targets [49]. In addition to implementing the gamification approach, building a comprehensive KMS design by adding features based on user needs is suggested as another solution to enhance user participation and motivation [47]. The study emphasizes that KMS development should consider the user side to prevent resistance to KMS usage. Furthermore, user satisfaction is crucial based on user behavior toward

the system [47]. Sensuse et al. [57] combined the adoption of Joint Application Development (JAD) and Fernandez methodology to build a KMS that facilitates the business process at university assistant lecturer institutions. Adopting both methods aims to meet user needs precisely, including adding a customer helpdesk feature as a platform for questions, answers, and complaints to be submitted by assistants [47]. Almujally & Joy [37] also added a user feedback feature to document learning experiences shared by instructors. Both features are incorporated to accompany KMS users so that they do not feel alone when using it, motivating them to participate due to feedback received from other users.

The issue of user collaboration is also identified as one of the challenges in developing KMS within the people element. There is a need to establish effective coordination among course coordinators and other assistant lecturers [47]. Good coordination ensures that lectures proceed in a structured and systematic manner. Two features were introduced to address this challenge, namely, communication tools and an issue management feature. The communication tools include discussion forums, which enable accompanying lecturers to discuss matters related to courses, with discussions automatically documented [47]. The issue management feature is designed to document problems and solutions that have occurred, enabling the reuse of previously applied solutions for similar issues due to their well-documented nature [47]. Both features are implemented to address constraints in user collaboration within the KMS and are tailored to meet the specific needs of the users.

The author categorizes problems within the process element in Table 7 into knowledge, documentation information, and competition. The knowledge aspect refers to problems in the process of sharing knowledge among organizational members, such as lesson learned [19,46], knowledge sharing [18,23,33,34,37,40,46], and store knowledge [18,32,34,40]. The documentation and information aspect pertains to information management problems in the organizational business processes through KMS, such as document access [19,47], manual data search [17], and information limitations [41]. The competition aspect involves problems in the quality management of knowledge within the organization to ensure its competitiveness against other organizations, such as quality of knowledge management [40], quality of education [35,43], and branding [39]. Among these aspects, the knowledge-sharing process is identified as the most prevalent issue compared to other aspects. The author found commonality on matters related to knowledge sharing in seven pieces of literature they reviewed.

In the knowledge aspect, the encountered issue is the lack of learning from past experiences [19,46]. This problem stems from the difficulty in accessing lessons and solutions related to previously applied issues, preventing the ability to relearn from mistakes and make progress in solving future problems [19,46]. The need to document, share, and apply knowledge is also a problem related to lessons learned. This need aims to facilitate the publication of knowledge sources, improve teaching quality, and support the development of academic instructors [19,46].

The issue of insufficient learning from past experiences led to the creation of a best practice template in KMS as a platform for documenting knowledge in a more comprehensive and structured manner. This document aims to provide instructors with access to document their knowledge more comprehensively and structured. Consequently, other instructors can quickly learn knowledge about best practices in teaching methods in the future [19,46].

Another issue within the knowledge aspect is the challenge of sharing [18,23,33,34,37,40,46] and storing knowledge [18,32,34,40]. The need for knowledge sharing arises from the loss of teaching-related knowledge from retired instructors, making it difficult for subsequent instructors to fulfill subject knowledge requirements for the courses they will teach [10]. Poor knowledge sharing also leads to low levels of learning achievement [18,32,34,40]. Knowledge sharing is crucial in higher education, particularly for instructors to apply knowledge and facilitate effective teaching processes [10]. Additionally, knowledge sharing is necessary to enhance long-term competitive advantage and sustainable development in organizational business processes [33]. Knowledge storage is needed to optimize knowledge sharing. Without the storage of knowledge, it becomes challenging to carry out knowledge sharing to achieve business process goals effectively [34]. Therefore, the need for knowledge sharing and storage poses a motivating challenge in the knowledge aspect of the development of KMS.

As previously explained, creating a best practice template serves as a solution to address the issues of knowledge sharing and knowledge [32,47]. Well-documented knowledge facilitates structured knowledge storage, easing the process of knowledge sharing. Additionally, organizing knowledge from experts is a solution to tackle knowledge storage issues [50]. This approach allows knowledge to be a reliable learning reference for KMS users in the future since it originates from competent experts.

In the documentation and information aspect, there are issues related to document access [19,47]. This problem arises due to the lack of documentation on previously applied issue resolutions, making it difficult to learn from past knowledge without access to the documentation [19,47]. Furthermore, tasks performed by organizational members in business processes need to be organized and documented [47]. This highlights the importance of document access, motivating the development of KMS within the organization. The appropriate solution to this issue is implementing effective document management within the KMS [36]. This solution is implemented by creating an issue management

feature containing documentation related to problems and their solutions, making both easily accessible for future learning [36]. In other words, KMS development is undertaken as a platform to store information, lessons learned, and documentation from issue resolutions.

Manual data searching also becomes a problem in information and documentation [19,47]. This issue arises when members of the organization want to study the specific problems or events that occurred in the past. The lack of proper documentation makes it difficult to search for specific knowledge. Implementing a data search tool is proposed as a solution to the problem of manual data searching. Rampisela et al. [41] created an expert locator system in the KMS to display information comprehensively. The system allows searches based on the names of lecturers/researchers at Fasilkom UI and publication keywords, and it also displays co-authors. The system directly shows the name, affiliation, H-index, and the ten best publication keywords of the searched co-author. Almujally Joy [56] also created a search tool that facilitates knowledge retrieval in the KMS. Efficient search features were also developed by Alsaleh & Haron [50] to address this issue. The search feature can centralize knowledge storage in the KMS [40]. Moreover, the search feature can facilitate the search for experts in the knowledge of interest within the KMS [20]. These studies are real examples of applying search features in the KMS to address the problem of manual data searching in organizations.

The need for data integration is also a problem that motivates the development of the KMS. Various databases owned by organizations store various types of data, including knowledge, documents, and so on, so integrated data is needed to connect these data [20]. Creating a visual analytic report by Lee et al. [17] is an appropriate solution to address this issue. The visual analytic report helps understand the data relationships from various databases through visualization in the form of a hierarchy. Furthermore, creating a repository is also an appropriate solution to address this issue. Ait-Bennacer et al. [35] created a repository specifically designed for a research laboratory. Its purpose is to provide relevant decision support to laboratory researchers in conducting research [35].

The limitation of information needed in the organizational business process also becomes a problem that motivates the development of the KMS. In the study by Rampisela et al. [41], there was a problem with limiting information related to co-authors in the Scopus, Sinta, and Scholar UI databases. The appropriate solution from previous research to address this issue is article management. Sensuse et al. [47] created a feature for article management that contains SOP documents, quiz questions, and guidelines for assessing tasks and tutorials intended as references for assistant lecturers in the faculty to perform their duties. Article management serves as a guide to provide the necessary information to members of the organization while performing tasks in the organizational business process. Another solution is to create content categorization to address information limitations, as it can help provide diverse information needed by the organization [50]. Another solution is to create a recommendation feature that provides information as required at a given time [35].

In the competition aspect, there are problems in maintaining quality in knowledge management [40], quality in education [35], branding [39], and competitive advantage [39]. Two solutions that have been applied by previous research and are appropriate to address these issues are security development in the KMS [40] and notification creation [50]. Security development aims to prevent sensitive information in the organization from being known by others who do not have the right to know [40]. This solution helps maintain the quality of knowledge in the KMS so that sensitive information is protected from unauthorized parties. Then, the notification feature aims to increase awareness among members of the organization so that they are aware of the addition of new knowledge, ensuring the quality of knowledge management [50]. This feature makes members of the organization actively involved in obtaining shared knowledge in the KMS due to increased awareness. It can also become a competitive advantage for the organization because of the uniqueness of implementing these two features. Therefore, security development and notification features are proposed solutions that are appropriate for addressing the issues in the competition aspect.

Lastly, the author identified two technological issues, such as the need for a centralized system [40] and the requirement for integrated data [20]. This need arises due to the difficulties experienced by university staff in sharing their knowledge [40]. They also want to capture and store knowledge in a centralized system for easy access [40]. Problems related to system integration occur when the data used comes from several databases [20]. Data integration also connects various knowledge and information that were initially separated [20].

The issues identified in the technology element give rise to proposed solutions found in research conducted by Young et al. [14] regarding cloud-based storage. This cloud-based storage supports database integration that enhances collaboration between departments and interconnects them as a centralized database [46]. The cloud is a cutting-edge technology that provides space for data storage at competitive costs [50]. There are several advantages to implementing KMS using cloud-based solutions, including more centralized knowledge sharing, ease of adoption, and ensured security when using private cloud services [14]. Adopting a private cloud for knowledge storage can eliminate security risks that may occur in knowledge storage [50]. Additionally, cloud technology allows organizations to adopt this technology to save costs as they do not require expenses for infrastructure, maintenance, and staff [50]. Therefore,

leveraging the cloud for integrated and easily accessible database solutions can be a technological aspect of addressing the need for centralized system integration [46]. Cloud technology enables data to be stored centrally and accessed by every organization member who requires it.

B. Knowledge Management System Solutions

In data extraction, the author found several proposed solutions from previous research to address the issues identified in the organizational business processes. These developed systems, shown in Table 8, have different objectives and contexts. These previously developed system can inspire KMS development teams or further research to adopt similar systems according to their needs.

Research by Hidayat et al. [27] developed a Scholarly Publication System for academic publications in higher education with various solutions such as data search tools and recommendations [27]. In line with this, previous Document Management System developments aimed to enhance the capture, storage, and sharing capabilities of staff in higher education with a user-friendly system design [40]. Another study also developed a Research Management System to address quality assurance issues in educational management and maintain knowledge sharing to improve long-term competitive advantage and sustainable development [33]. These systems can support the research process in higher education and increase scientific publication productivity.

In other work, a studio-based learning system has been used to help students learn solutions used in previous semester assignments and to facilitate data collection for final semester projects [19]. Similarly, a Teaching Assistant Knowledge Management System was implemented to educate teaching assistants with comprehensive features to document tasks, share information, assess guidelines, and coordinate [47]. Another study developed a Curriculum Education Management System to facilitate sharing, development, storage, and information retrieval through a website platform as a sustainable collaborative tool [43]. By implementing these systems, students and lecturers can optimize the teaching and learning process with appropriate knowledge management facilities.

Research conducted by Almujally and Joy in three different studies developed the Teaching Practices Management System (TPMS). The development of TPMS implements gamification in KM to motivate knowledge sharing, and KMS is an intermediary in sharing and learning the best teaching practices of lecturers with ranking, feedback, and incentives [46]. TPMS is created by providing templates to help document the knowledge of each lecturer so that their knowledge is not lost and by providing search tools for easy retrieval [18,32]. Meanwhile, Almujally and Joy's research on the Teaching Experience Management System (TEMS) only defines the system requirements by identifying problems and solutions in knowledge management practices at Saudi Arabian Universities [32]. Both TPMS and TEMS are systems that can support teaching in higher education and make it easier for lecturers to learn from more senior colleagues.

Furthermore, a system facilitates the search for experts in the desired field of knowledge and identifies the main scientific priorities of universities and lecturers through the Knowledge Ontological Base System [20]. This aligns with the expert locator system that provides information about co-authors, including location, publication keywords, impact, and productivity [41]. An expertise search system is also developed to monitor the capabilities of experts in developing projects to plan the institution's competitive advantage [39]. Several of these developed systems can be adopted to enhance ease in searching for experts in upcoming research.

Other research on system development includes the Guidance and Counselling Support System, which minimizes the risk of human error in handling student cases, especially in counseling management [17]. Another study also developed a Knowledge Management System-Total Quality Management as a system supporting the digital transformation process of laboratories by storing knowledge in a specific repository to assist in decision-making [35]

C. Recommendation for Future Research

This study found future research based on the discussion of previous results. The recommendations include developing KMS for new business processes, implementing KMS with a combination of methodologies, and identifying the influence of individual behavior on implementing new technologies in KMS. An explanation of each of these three recommendations will be discussed in the next section.

1) Development of KMS for New Business Processes

Based on a literature review that has been done before, several KMS were developed in several university business process sectors. Examples of KMS implementation include searching for expert data, sharing knowledge and experience in teaching, quality testing, counseling services, and so on, as explained in Table 8. However, system development in universities is not limited to these sectors. Some opportunities have the potential to bring novelty to the development of KMS in future research. Researchers can try to identify constraints on ongoing business processes and offer solutions with new systems.

Developing a system for business processes not covered in this research can be an innovation in the realm of KMS in higher education. Researchers can adopt alternative solutions offered in this study on different aspects of business processes. The author's mapping is expected to be a guide, guideline, and reference for further research. Moreover, the author has mapped the problem based on the people, process, and technology framework. With this mapping, it is hoped that further research will make it easier to find alternative solutions based on problems that are constraints on business processes. In addition, this mapping can also be a trigger to motivate the development of KMS in higher education.

2) KMS Implementation with a Combination of Methodologies

Some previous studies have only made low or high-fidelity prototypes and have not implemented the design [17,32,35,37,39,46,47]. Previous research also only presented a framework to make it easier for readers to understand the theoretical framework of KMS in higher education [50,58]. However, only one study developed KMS as a ready-to-use system for users. The research utilizes waterfall as a software development life cycle and a project management methodology [39]. Meanwhile, other studies use feature-driven development agile models as a methodology for making design and system design [43].

Apart from the lack of research implementing the system, further research can develop KMS planned with various methodologies relevant to project management. These methodologies include Scrum, kanban, waterfall, Six Sigma, etc. Future research can use one or combine several methods based on project needs so that it becomes a combination of new methodologies to develop a system. Thus, combining methods becomes a novelty in the research that is to be carried out.

3) Identifying the Influence of Individual Behavior on the Implementation of New Technologies in KMS

Previous research has examined individual behavior in adopting and utilizing KMS in organizational business processes in higher education [49]. Technical and social factors can influence the adoption of KMS in higher education's teaching and learning process, affecting student academic performance [36]. Both studies have examined the factors that influence individual behavior towards KMS adoption in general but have not explicitly examined how implementing a new technology on KMS affects individual behavior.

Almujally & Joy [37] have made a practical contribution by applying gamification to KMS in higher education. However, the study has not made any theoretical contributions showing the impact of gamification implementation on the behavior of individuals who use it. This limitation can be used as a novelty for future research where further research can analyze what factors influence individual behavior towards KMS adoption with the application of gamification. The analysis is expected to provide empirical evidence to obtain valid evidence to show how individual behavior influences the implementation of gamification in KMS. Thus, the research idea's results can prove whether gamification implementation in KMS can have a significant effect.

D. Limitations

This study has limitations on the domain discussed as one of the inclusion criteria in literature voters. The author only uses literature discussing knowledge management practices and system development. This means that the problems and solutions discussed in the final result of this study do not cover various domains. It is possible that alternative solutions carried out in previous research in different domains can be applied to the domain of higher education. Nevertheless, the author's main objective limiting the domain of higher education is to present comprehensive and structured data so that future research can make this research a reference in developing KMS. The alternative solutions presented are also minimal risk because they are applied to the same domain, namely higher education.

VI. CONCLUSIONS

This research comprehensively explains problems and solutions in developing KMS in higher education. This study uses literature published for the last five years, from 2019 to 2023. The author obtained the final paper after selecting titles and abstracts, inclusion and exclusion criteria, full-text selection, and quality tests of 23 literature. Based on the review of the final paper, the author identifies each literature to answer three research questions. To address RQ1 concerning the trends in the implementation of KMS in higher education, the authors identified the countries, data collection methods, research methodologies, and theories utilized in previous studies. Subsequently, two figures were presented to visualize the distribution of countries and data collection methods, along with a table delineating the identified research methodologies and theories.

The results of this study display the mapping of problems that motivate the development of KMS with alternative solution requirements to answer RQ2 and RQ3. The author presents a table that makes it easier for readers or subsequent researchers to find solutions to problems in organizational business processes in higher education. The people-process-technology framework classifies the table. The people element includes several issues such as user

participation and motivation, human aspect behavior, and the need for collaboration. The problems of the people element are expected to be overcome with several solutions, such as gamification, user feedback, user-friendly interface, customer helpdesk, communication tools, and issue management. Process problems include document access, manual data search, information limitations, knowledge management quality, education, branding, and competitive advantage. Several solutions to overcome these process elements include document management, visual analytic reports, data search tools, repositories, content categorization, recommendations, article management, security, and notifications. Finally, the problem with the technology element is the need for a centralized system and integrated data. This technology problem can be overcome with centralized databases and cloud computing. In addition, the author has also presented a table containing various KMS that have been developed in previous studies, such as studio based learning system, research management system, scholarly publication system, document management system, curriculum education management system, teaching assistant knowledge management system, teaching practices management systems, guidance, and counseling support systems, knowledge ontological base systems, expert locator systems, expertise search system, teaching experience management system, knowledge management system-total quality management.

Based on the author's analysis results, there are three recommendations for the following study. The first recommendation relates to developing KMS for new processes using the author's SLR results to determine solution requirements. The second recommendation is to implement KMS with various combinations of methodologies that users can use directly. Finally, the third recommendation is to identify the influence of individual behavior on implementing new technologies in KMS.

Although this research has limitations, the results of research conducted by the authors can add valuable insights to improve our understanding of the development of KMS in universities in various countries. The results of this study also provide alternative solutions to solving problems in university business processes so that they can be used as a reference for the development team in developing KMS. Further research can be done by identifying new potential in KMS in business processes currently running in a university with appropriate methodologies.

Author Contributions: *Nandhita Zefania Maharani*: Conceptualization, Methodology, Writing - Original Draft, Writing - Original Draft, Writing - Review & Editing. *Shabrina Salsabila Kurniawan*: Conceptualization, Methodology, Writing - Original Draft, Writing - Original Draft, Writing - Review & Editing. *Dana Indra Sensuse*: Writing - Review & Editing, Supervision. *Imairi Eitiveni*: Writing - Review & Editing, Supervision. *Deden Sumirat Hidayat*: Writing - Review & Editing, Supervision. *Erisva Hakiki Purwaningsih*: Writing - Review & Editing, Supervision.

All authors have read and agreed to the published version of the manuscript.

Funding: This research received no specific grant from any funding agency

Conflicts of Interest: The authors declare no conflict of interest.

Data Availability: Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Institutional Review Board Statement: Not applicable.

Informed Consent: There were no human subjects.

Animal Subjects: There were no animal subjects.

ORCID:
Nandhita Zefania Maharani: https://orcid.org/0009-0007-4740-7157
Shabrina Salsabila Kurniawan: https://orcid.org/0009-0005-4077-673X
Dana Indra Sensuse: https://orcid.org/0000-0002-0012-8552
Imairi Eitiveni: https://orcid.org/0000-0002-4039-2243
Deden Sumirat Hidayat: https://orcid.org/0000-0002-1847-8665
Erisva Hakiki Purwaningsih: https://orcid.org/0009-0009-3156-9316

REFERENCES

[1] I. Becerra-Fernandez and R. Sabherwal, *Knowledge Management Systems and Processes 2nd Edition*. Routledge, 2015.
[2] E. Turban, J. Outland, D. King, L. Jae Kyu, L. Ting-Peng, and D. C.Turban, *Electronic Commerce 2018: A Managerial and Social Networks Perspective Ninth Edition*. 2018.
[3] A. Subramaniam, I. Jones, and L. Miller, *Knowledge Management for Dummies, eGain Special Edition*. John Wiley & Sons, 2023.
[4] E. Abad-Segura and M.-D. González-Zamar, "Knowledge Management in Higher Education Institutions," in *Enhancing Academic Research and Higher Education with Knowledge Management Principles*, 2021. doi: 10.4018/978-1-7998-5772-3.CH005.
[5] A. Anderton and K. Watson, "Knowledge Management: a Technology Transfer Perspective," *International Political Economy: Globalization eJournal*, 2018, doi: 10.2139/ssrn.3241729.
[6] N. J. Navimipour and Y. Charband, "Knowledge sharing mechanisms and techniques in project teams: Literature review, classification, and current trends," *Comput. Hum. Behav.*, vol. 62, pp. 730–742, 2016, doi: 10.1016/j.chb.2016.05.003.
[7] M. F. Manesh, M. Pellegrini, G. Marzi, and M. Dabić, "Knowledge Management in the Fourth Industrial Revolution: Mapping the Literature and Scoping Future Avenues," *IEEE Trans Eng Manag*, vol. 68, pp. 289–300, 2021, doi: 10.1109/TEM.2019.2963489.
[8] T. Oktavia, H. L. S. Warnars, and S. Adi, "Conceptual Model of Knowledge Management and Social Media to Support Learning Process in Higher Education Institution," *TELKOMNIKA Telecommunication Computing Electronics and Control*, vol. 15, pp. 678–685, 2017, doi: 10.12928/TELKOMNIKA.V15I2.3491.
[9] A. S. M. Noor, M. Younas, and M. Arshad, "A review on cloud based knowledge management in higher education institutions," *International Journal of Electrical and Computer Engineering*, vol. 9, no. 6, pp. 5420 – 5427, 2019, doi: 10.11591/ijece.v9i6.pp5420-5427.
[10] S. T. YIGZAW, I. JORMANAINEN, AND M. TUKIAINEN, "TRENDS IN THE ROLE OF ICT IN HIGHER EDUCATION KNOWLEDGE MANAGEMENT SYSTEMS: A SYSTEMATIC LITERATURE REVIEW," ACM INTERNATIONAL CONFERENCE PROCEEDING SERIES, PP. 473–480, 2019, DOI: 10.1145/3362789.3362805.
[11] A. Sanmorino, Ermatita, and Samsuryadi, "The preliminary results of the kms model with additional elements of gamification to optimize research output in a higher education institution," *Int J Eng Adv Technol*, vol. 8, no. 5, pp. 554–559, 2019.
[12] M. R. Abdullah, K. Ahmad, and N. F. Elias, "Knowledge Management System Implementation and The Performance of Higher Education Institutions in The Developing Countries: a Conceptual Framework," *J Theor Appl Inf Technol*, vol. 100, no. 24, pp. 4783 – 4798, 2022, [Online]. Available: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85145418979&partnerID=40&md5=0560e68933971e80fe2ce602c8fef074
[13] S. Ibrahim and K. Shaalan, "A Systematic Review of Knowledge Management Integration in Higher Educational Institution with an Emphasis on a Blended Learning Environment," *Lecture Notes in Networks and Systems*, vol. 550 LNNS, no. May, pp. 319–339, 2023, doi: 10.1007/978-3-031-16865-9_25.
[14] Z. Chen, I. C. C. Chan, F. Mehraliyev, R. Law, and Y. Choi, "Typology of people–process–technology framework in refining smart tourism from the perspective of tourism academic experts," *Tourism Recreation Research*, Aug. 2021, doi: 10.1080/02508281.2021.1969114.
[15] M. R. Hosseini, H. Tahsildari, M. T. Hashim, and M. A. Tareq, "The Impact of People, Process and Technology on Knowledge Management the Impact of People, Process and Technology on Knowledge Management," *European Journal of business and Management*, vol.6, no. October, 2014.
[16] R. Ahamad and K. N. Mishra, "Intelligent Computing Methods for Knowledge Discovery and Management: Analysis, Comparison, and Application Domains," *Proceedings of 2nd International Conference on Advancements in Smart, Secure and Intelligent Computing, ASSIC 2024*, pp. 1–8, 2024, doi: 10.1109/ASSIC60049.2024.10508021.
[17] D. Lee, J. K. P. Julian, R. M. P. Caparas, and G. L. D. Intal, "MyCounselor: Guidance and Counseling Support System for Higher Education Institute in the Philippines," in *Proceedings of the 2019 3rd International Conference on Software and E-Business*, in ICSEB '19. New York, NY, USA: Association for Computing Machinery, 2020, pp. 1–5. doi: 10.1145/3374549.3374578.
[18] N. Almujally and M. Joy, "Design and Evaluation of a Teaching-Related Knowledge Sharing System to Meet the Needs of Computer Science Instructors," in *Proceedings - Frontiers in Education Conference, FIE*, 2020. doi: 10.1109/FIE44824.2020.9274215.

[19] S. H. Ahn and C. Choi, "Studio Based Learning using Programmable Knowledge Management System," in *2019 18th International Conference on Information Technology Based Higher Education and Training (ITHET)*, IEEE, Sep. 2019, pp. 1–8. doi: 10.1109/ITHET46829.2019.8937331.
[20] G. Zhomartkyzy, S. Kumargazhanova, G. Popova, and L. Suleimenova, "Development of university scientific knowledge ontological model," in *ACM International Conference Proceeding Series*, 2019, pp. 40 – 45. doi: 10.1145/3343485.3343500.
[21] J. S. Edwards, "Are the Knowledge Management Times «a-changin»" In: *Proceedings of the European Conference on Knowledge Management, ECKM*, 2019, doi: 10.34190/EKM.20.056.
[22] A. Taher and A. Taher, "Stakeholders' opinions support the people- process-technology framework for implementing digital transformation in higher education education," *Technology, Pedagogy and Education*, vol. 00, no. 00, pp. 1–13, 2023, doi: 10.1080/1475939X.2023.2248134.
[23] A. S. M. Noor, M. Younas, and M. Arshad, "A review on cloud based knowledge management in higher education institutions," *International Journal of Electrical and Computer Engineering*, vol. 9, no. 6, pp. 5420 – 5427, 2019, doi: 10.11591/ijece.v9i6.pp5420-5427.
[24] S. Kitchenham, Barbara Ann and Charters, "Guidelines for performing systematic literature reviews in software engineering," *Technical report, Ver. 2.3 EBSE Technical Report. EBSE*, vol. 1, no. January 2007, pp. 1–54, 2007.
[25] B. Kitchenham and P. Brereton, "A systematic review of systematic review process research in software engineering," *Information and Software Technology*, vol. 55, no. 12. 2013. doi: 10.1016/j.infsof.2013.07.010.
[26] M. A. W. Putra Rahmadhan, D. I. Sensuse, R. R. Suryono, and Kautsarina, "Trends and Applications of Gamification in E-Commerce: A Systematic Literature Review," *Journal of Information Systems Engineering and Business Intelligence*, vol. 9, no. 1, 2023, doi: 10.20473/jisebi.9.1.28-37.
[27] D. S. Hidayat, D. I. Sensuse, D. Elisabeth, and L. M. Hasani, "Conceptual model of knowledge management system for scholarly publication cycle in academic institution," *VINE Journal of Information and Knowledge Management Systems*, 2022, doi: 10.1108/VJIKMS-08-2021-0163.
[28] A. Mory-Alvarado, C. Juiz, B. Bermejo, and M. Campoverde-Molina, "Green IT in small and medium-sized enterprises: A systematic literature review," *Sustainable Computing: Informatics and Systems*, vol. 39, no. January, p. 100891, 2023, doi: 10.1016/j.suscom.2023.100891.
[29] H. Gunatilake, J. Grundy, R. Hoda, and I. Mueller, "The impact of human aspects on the interactions between software developers and end-users in software engineering: A systematic literature review," *Inf Softw Technol*, vol. 173, no. January, p. 107489, 2024, doi: 10.1016/j.infsof.2024.107489.
[30] H. W. Awalurahman, I. H. Witsqa, I. K. Raharjana, and A. H. Basori, "Security Aspect in Software Testing Perspective: A Systematic Literature Review," *Journal of Information Systems Engineering & Business Intelligence*, vol. 9, no. 1, pp. 95–107, 2023.
[31] I. K. Raharjana, D. Siahaan, and C. Fatichah, "User Stories and Natural Language Processing: A Systematic Literature Review," *IEEE Access*, vol. 9, pp. 53811–53826, 2021, doi: 10.1109/ACCESS.2021.3070606.
[32] N. Almujally and M. Joy, "Designing an artefact for sharing and reusing teaching practices in higher education institutions: An exploratory study," *Advances in Intelligent Systems and Computing*, vol. 1038, pp. 1234 – 1242, 2020, doi: 10.1007/978-3-030-29513-4_89.
[33] S. Nupap, "Knowledge Management System by applying Knowledge Creating Company: Transforming Tacit to Explicit Knowledge," in *7th International Conference on Digital Arts, Media and Technology, DAMT 2022 and 5th ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering, NCON 2022*, 2022, pp. 439 – 444. doi: 10.1109/ECTIDAMTNCON53731.2022.9720388.
[34] F. N. Onifade, A. A. Oyelude, and K. O. Uthman, "Knowledge Management Practices (KMP) in University Libraries in Nigeria: Connecting and Inspiring Librarians for Professional Development," *International Information & Library Review*, vol. 55, no. 1, pp. 86–94, Jan. 2023, doi: 10.1080/10572317.2023.2159623.
[35] F.-E. Ait-Bennacer, A. Aaroud, K. Akodadi, and B. Cherradi, "Adopting a Digital Transformation in Moroccan Research Structure using a Knowledge Management System: Case of a Research Laboratory," *International Journal of Advanced Computer Science and Applications*, vol. 13, no. 9, pp. 375 – 384, 2022, doi: 10.14569/IJACSA.2022.0130943.
[36] A. Owusu, "Knowledge Management Systems Implementation Effects on University Students' Academic Performance: The Socio-Technical Theory Perspective," *Educ Inf Technol (Dordr)*, 2023, doi: 10.1007/s10639-023-11999-9.
[37] N. Almujally and M. Joy, "Applying a Gamification Approach to Knowledge Management in Higher Education Institutions," in *Proceedings - 2020 IEEE 44th Annual Computers, Software, and Applications Conference, COMPSAC 2020*, 2020, pp. 455 – 459. doi: 10.1109/COMPSAC48688.2020.0-209.

[38] F. Altınay, M. Altınay, G. Dagli, and Z. Altınay, "A study of knowledge management systems processes and technology in open and distance education institutions in higher education," *International Journal of Information and Learning Technology*, vol. 36, no. 4, pp. 314 – 321, 2019, doi: 10.1108/IJILT-02-2019-0020.
[39] Sugianto, Z. Abidin, A. T. Putra, and K. Budiman, "Knowledge management system in a higher education institution: Development of an expertise search system," in *Journal of Physics: Conference Series*, 2021. doi: 10.1088/1742-6596/1918/4/042021.
[40] D. E. Maligat, J. O. Torio, R. T. Bigueras, M. C. Arispe, and T. D. Palaoag, "Web-based Knowledge Management System for Camarines Norte State College," in *IOP Conference Series: Materials Science and Engineering*, 2020. doi: 10.1088/1757-899X/803/1/012006.
[41] T. V. Rampisela, D. Indra Sensuse, D. Elisabeth, and N. Ayu Wigati S. Subroto, "Expert Locator System for Finding Co-Authors Using Snowball Network Method: A Case Study of Fasilkom UI Lecturers," in *2020 The 4th International Conference on Education and Multimedia Technology*, in ICEMT 2020. New York, NY, USA: Association for Computing Machinery, 2020, pp. 6–13. doi: 10.1145/3416797.3416831.
[42] A. A. Mohammed, "Assessing the Success of the Perceived Usefulness for Knowledge Management Systems: A Case Study of Iraqi Higher Education," *International Journal of Knowledge Management*, vol. 18, no. 1, 2021, doi: 10.4018/IJKM.291098.
[43] D. Galeon, "Towards a sustainable outcomes-based education guided by knowledge management system: expoleIT design and development roadmap," in *Proceedings of the 2022 IEEE 7th International Conference on Information Technology and Digital Applications, ICITDA 2022*, 2022. doi: 10.1109/ICITDA55840.2022.9971357.
[44] D. S. Hidayat, D. I. Sensuse, D. Elisabeth, and L. M. Hasani, "Conceptual model of knowledge management system for scholarly publication cycle in academic institution," *VINE Journal of Information and Knowledge Management Systems*, 2022, doi: 10.1108/VJIKMS-08-2021-0163.
[45] N. Almujally and M. Joy, "Design and Evaluation of a Teaching-Related Knowledge Sharing System to Meet the Needs of Computer Science Instructors," in *Proceedings - Frontiers in Education Conference, FIE*, 2020. doi: 10.1109/FIE44824.2020.9274215.
[46] N. Almujally and M. Joy, "Towards a template-driven approach to documenting teaching practices," *International Conference on Intelligent Tutoring Systems*, vol. 12149 LNCS, pp. 388 – 396, 2020, doi: 10.1007/978-3-030-49663-0_47.
[47] D. I. Sensuse, H. N. Rochman, S. Al Hakim, and W. Winarni, "Knowledge management system design method with joint application design (JAD) adoption," *VINE Journal of Information and Knowledge Management Systems*, vol. 51, no. 1, pp. 27 – 46, 2021, doi: 10.1108/VJIKMS-10-2018-0083.
[48] P. Offermann, O. Levina, M. Schönherr, and U. Bub, "Outline of a design science research process," *Proceedings of the 4th International Conference on Design Science Research in Information Systems and Technology, DESRIST '09*, no. June 2014, 2009, doi: 10.1145/1555619.1555629.
[49] A. S. Rashid, K. Tout, and A. Yakan, "The critical human behavior factors and their impact on knowledge management system–cycles," *Business Process Management Journal*, vol. 27, no. 6, 2021, doi: 10.1108/BPMJ-11-2020-0508.
[50] S. Alsaleh and H. Haron, "A Knowledge Sharing System Requirements Framework for Academic Institutions," in *Proceedings of the 11th International Conference on Computer Modeling and Simulation*, in ICCMS '19. New York, NY, USA: Association for Computing Machinery, 2019, pp. 219–224. doi: 10.1145/3307363.3307368.
[51] D. Abaoud, "The relationship between knowledge management practices and enterprise risk management in higher education: An action research," *27th European Conference on Information Systems - Information Systems for a Sharing Society, ECIS 2019*, pp. 0–15, 2020.
[52] M. Simanjuntak, S. A. Manalu, and R. D. H. Tobing, "Towards an institute of technology: A knowledge management system challenges in the perspective of academic and student administration bureau," *J Teknol*, vol. 78, no. 6–3, pp. 71–76, 2016, doi: 10.11113/jt.v78.8931.
[53] N. V. Dneprovskaya and I. V. Shevtsova, "A knowledge management system in the strategic development of universities," *Business Informatics*, vol. 17, no. 2, pp. 20–40, 2023, doi: 10.17323/2587-814X.2023.2.20.40.
[54] H. M. Oumran, R. B. Atan, R. N. H. Binti Nor, S. B. Abdullah, and M. Mukred, "Knowledge Management System Adoption to Improve Decision-Making Process in Higher Learning Institutions in the Developing Countries: A Conceptual Framework," *Math Probl Eng*, vol. 2021, 2021, doi: 10.1155/2021/9698773.
[55] F. Mohiddin, H. Susanto, and F. Ibrahim, "Implications of knowledge management adoption within higher education institutions: Business process reengineering approach," In: *Handbook of research on analyzing IT opportunities for inclusive digital learning*.2021, pp. 307–351. doi: 10.4018/978-1-7998-7184-2.ch016.

[56] N. Almujally and M. Joy, "A Framework for Improving the Sharing of Teaching Practices among Computer Science Instructors," in *Proceedings of the 2019 ACM Conference on Innovation and Technology in Computer Science Education*, in ITiCSE '19. New York, NY, USA: Association for Computing Machinery, 2019, p. 294. doi: 10.1145/3304221.3325590.
[57] M. A. H. Sutoyo, H. Priyambowo, A. Nurzahra, D. I. Sensuse, S. Al Hakim, and D. Satria, "Knowledge Management System Design using Gamification: A Case study of the e-Government Laboratory, Universitas Indonesia," in *2019 International Conference on Computer, Information and Telecommunication Systems (CITS)*, 2019, pp. 1–5. doi: 10.1109/CITS.2019.8862040.
[58] M. A. Alsharidah and P. Newbury, "A Framework for Capturing and Sharing E-Learning Design Best Practices," in *Proceedings of the 2022 5th International Conference on Education Technology Management*, in ICETM '22. New York, NY, USA: Association for Computing Machinery, 2023, pp. 226–230. doi: 10.1145/3582580.3582620.