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☐ **Digital Transformation for Institution Operations in Higher Education: A Literature Review**

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SURVEY

Digital Transformation for Institution Operations in Higher Education: A Literature Review

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ABSTRACT In recent years, higher education institutions (HEIs) have increasingly embraced digital technology to optimize admissions, enhance student recruitment through digital marketing, and facilitate online learning. The COVID-19 pandemic has significantly accelerated this shift, reshaping education through digital transformation (DT) in HEI. This study examines the relationships between digital transformation leadership, digital agility, and the execution of smart campus models. It delineates the principal problems and opportunities HEIs encounter in the adoption of new technology. This study presents a comprehensive literature analysis that outlines the critical elements of efficient smart management, including resource management, institutional collaboration, and enhancement of digital competencies among educators. These findings emphasize the importance of stakeholders adopting systematic procedures while implementing digital transformation strategies to improve operational efficiency and stakeholder involvement. Addressing issues such as digital culture, leadership dedication, and resource allocation is critical for higher education institutions to meet rising academic requirements and remain competitive in a global setting. This report is a valuable resource for Indonesian HEIs seeking to navigate changes and improve educational quality in the digital era.

INDEX TERMS Academic standards, digital transformation, higher education institutions, institution operations.

I. INTRODUCTION

Currently, the world has entered the Industrial Revolution 4.0, which affects all human lives and poses challenges for organizations that still traditionally run their businesses [1]. Digital Transformation (DT) integrates digital technology into all elements of an organization, where DT can make radical operational changes and provide added value to customers. DT also influences changes in work techniques, activities, and business practices as a result of the use of digital technology in organizations [2].

DT is currently also affecting Higher Education Institutions (HEI), where digital products are used to increase the number of incoming students by simplifying the admission process, using digital marketing to attract prospective stu-

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dents, reducing administrative activities usually carried out by employees, and changing the way of teaching and learning [3], [4]. With increasing technological improvements, higher education institutions are looking for methods to incorporate smart systems into their institutional operations to improve operational efficiency, decision-making, and the overall student experience. One important concept that has emerged in this context is Smart Campus, which refers to the use of digital technologies to manage and optimize campus operations [5]. Smart management in the context of higher education is characterized by the integration of technology, data-driven decision-making, collaboration, adaptability, stakeholder engagement, sustainability, and focus on continuous improvement. These elements work together to enhance the overall institutional operations within educational institutions, ultimately leading to better educational outcomes and institutional effectiveness. It involves the

use of digital tools and data analytics to streamline operations, improve decision making, and foster collaboration among stakeholders. Additionally, smart management emphasizes sustainability and adaptability, ensuring that institutions respond to changing circumstances while promoting a culture of innovation and digital transformation [6]. The alignment of Smart Campus (SC) and Smart Management (SM) models has emerged as an important field of study, as educational institutions seek to modernize and streamline their administrative procedures in response to technological advancements.

The use of digital technology occurred during the COVID-19 pandemic throughout the world, when almost all students experienced changes in their way of learning in a very short time. Here, teachers and students must learn to use new technology because the education process is conducted online. This can be expressed as DT in the HEI [7], [8]. According to Imbar, DT is strongly influenced by the digital culture in higher education, leaders who are willing to transform, and the organization's commitment to providing adequate digital resources [9]. Digital culture is greatly influenced by changes in a person's way of working, including changes in rules and processes at higher education institutions. Challenges and difficulties in implementing DT are often caused by the resistance of the people involved. They feel comfortable because of their habits, fear of using new things they do not understand, fear of losing their job, and that change will only result in something bad. A leader's ability and agile organization are also influential in the DT of an HEI. The spirit of leadership must also be built in every part of the university, including designing digital strategies that can provide direction to each leader in each section by combining all the resources available in the HEI using technology. It can be concluded that the DT in an HEI can be described as a digital orchestra with a leader as a conductor [10].

This paper will use the Systematic Literature Review (SLR) method to search for several related studies that have been conducted by researchers on the use of DT focusing on institution operations in HEI [11]. This section discusses the research methods in more detail. The method used refers to the research question underlying the study to understand the smart management that has been implemented in several universities. Three research questions were used: understanding the relationship between the smart campus model and smart management in HEI (RQ1), what research areas related to smart management in HEI already exist (RQ2), and identifying which smart management models have been researched by researchers (RQ3). The study results from numerous papers can serve as a reference to understand the application of smart management and are expected to identify gaps that can be addressed in higher education institutions, particularly in Indonesia. This is done in response to changes or demands in terms of academic standards, academic quality, research knowledge, and filling gaps in community knowledge in the current era of globalization [12].

The primary contribution of this article is its thorough SLR, which consolidates current research on digital transformation and smart management in HEIs with a specific emphasis on the Indonesian context. This review identifies significant gaps in the empirical studies and practical applications of smart management models. Additionally, it introduces the Garuda Smart Campus Model (GSCM) as a guiding framework for Indonesian HEIs, enabling them to effectively navigate their digital transformation processes and improve educational outcomes in an increasingly competitive global environment [13].

To answer the research questions, we used the following steps:

1. Literature search to find keywords to search for key papers that serve as the basis for answering the research question. This process results in key papers when using Parsifal [11].
2. We studied the results from selected key papers to find their key findings relevant to research questions using the PICOC framework [11].
3. We use the key finding to answer research questions, report and discuss the results, conclude the state of the art in this subject and propose future research.

This paper is organized into several sections to provide a comprehensive understanding of the topics discussed.

1. **Introduction**: This section outlines the background and significance of digital transformation and smart management in HEIs, particularly Indonesia. This also highlights the main contributions of this study.
2. **Literature Review**: A detailed review of the relevant literature on digital transformation and smart management within HEIs is presented. This section identifies the existing models, frameworks, and research gaps in the field.
3. **Methodology**: This section describes the SLR approach used to gather and analyze selected studies. It includes the criteria for inclusion and exclusion of articles as well as the quality assessment process.
4. **Findings and Discussion**: In this section, the results of the literature review are discussed, including key insights into the relationship between smart campus models and smart management practices, as well as the implications of these findings for HEIs.
5. **Proposed Framework**: This section introduces GSCM and elaborates on its components and how it can be implemented to enhance digital transformation in Indonesian HEIs.
6. **Conclusion**: The final section summarizes the key findings, emphasizes the importance of smart management, and outlines future research directions for further study in this domain.

II. RELATED STUDIES
A. SMART CAMPUS
A smart campus (SC) is defined as the use of smart technology, including smart network infrastructure, devices,

and applications, to provide a connected and efficient learning experience. The concept of SC implies a system that can provide quick answers to student questions, online student admissions, and online lectures without place restrictions [13].

The SC in Indonesia does not have a conical meaning for mutual understanding and lacks standards. SC practice is spread across various areas in an unstructured and uneven manner, including governance, people, mobility, the environment, living, and the economy. The application of SC components and technology in Indonesia is limited and varied. SC is characterized by its ability to facilitate innovation, productivity, and social capacity through the integration of physical, economic, environmental, and social components. Knowledge management is an essential component of SC, and its implementation can be supported by various technologies such as Internet of Things (IoT), big data, and social network applications [14].

The concept of SC is an emerging trend that holds the potential to revolutionize the education system. SC initiatives aim to create technologically advanced and sustainable educational environments that meet the evolving needs of students, faculty, and staff. Integrating smart technology with the physical infrastructure of an SC can significantly enhance campus sustainability and improve decision-making [15].

An SC is an efficient, safe, sustainable, responsive, and enjoyable place to learn and work, underpinned by digital technologies. It provides a smart environment for training citizens to become more productive within an evolving smart-city framework. Certain characteristics are expected to be present on campus before it can be described as an SC, as follows:

- The concept of the university as a collection of people, amenities, and assets that respond to and are shaped by the values, expectations, and shifting demands of its citizens.
- Robust connectivity between operational and transactional capabilities.
- Significant investment in infrastructure and services.

An SC should be human-centered, learning-oriented, and have appropriate structures to support interdisciplinarity. Successful SC must consider the interplay between infrastructure, technology, and service layers and their influence on the ability of the SC to meet stakeholder expectations. The absence of a generic model for SC design and implementation has been highlighted, which makes the appraisal of SC performance challenging [16].

B. SMART MANAGEMENT

Smart management can be defined and understood through several key:

1. **Integration of Technology**: Smart management involves the use of advanced technologies to enhance decision-making processes, improve operational efficiency, and facilitate communication within HEIs.

This includes leveraging digital tools and platforms to streamline institutional processes and enhance service deliveries [15].

2. **Data-Driven Decision Making**: Smart management relies on data analytics and information management to inform strategic decisions. This approach emphasizes the importance of collecting, analyzing, and utilizing data to improve management practices and educational outcomes [17].

3. **Collaboration and Partnerships**: Effective smart management encourages collaboration among various stakeholders including faculty, staff, students, and industry partners. This collaborative approach helps to share best practices, resources, and knowledge, which are essential for fostering innovation and enhancing the overall educational experience [16].

4. **Adaptability and Agility**: Smart management requires institutions to be adaptable and agile in response to changing educational landscapes and technological advancements. This includes being open to new ideas, practices, and technologies to improve institutional processes and educational delivery [18].

5. **Focus on Stakeholder Engagement**: Smart management emphasizes the importance of engaging all stakeholders in the decision-making process. This includes clear communication of goals, values, and objectives as well as involving stakeholders in the implementation of management strategies [19].

6. **Sustainability and Long-term Vision**: Smart management incorporates sustainability principles, ensuring that management practices not only address current challenges, but also consider long-term impacts on the institution and its community. This involves creating a strategic vision that aligns with an institution's core mission and values [20].

7. **Continuous Improvement**: A key aspect of smart management is commitment to continuous improvement through regular monitoring and evaluation of management practices. This includes assessing the effectiveness of the implemented strategies and making the necessary adjustments based on feedback and performance metrics [17].

C. DIGITAL TRANSFORMATION

The Covid-19 pandemic has accelerated the need for DT in higher education institutions, forcing them to shift from traditional face-to-face teaching to online platforms [9], [21]. DT is essential for institutions to adapt to changing environments and to meet the demands of governments and customers. DT can help businesses accelerate their operations, processes, and competencies to fully capitalize on developments and opportunities in digital technology [9].

In higher education, DT involves the deployment of digital technologies to transform traditional teaching and learning. The shift to online teaching and learning has

seen the use of digital educational technologies such as learning management systems, online collaboration spaces, AI-generated applications, and mobile devices. Several frameworks have been developed to guide universities through the process of DT, including the KPMG DT framework and Google Education transformation framework [21].

DT is a rapidly growing trend and has become a top priority for HEI. This involves integrating digital technology into every step of the educational process, including teaching, scientific research, and resource management. The goal of DT is to provide the most convenient mechanisms to achieve universities' duties and contribute to society's development and empowerment. It involves integrating systems, reducing digital fragmentation, and adopting organizational processes and practices that align with new social and professional relationships. The goal is to prepare skills and the necessary skills for 21st-century learning and work, equip faculty with digital skills, and adopt innovative pedagogical methodologies. DT can bring numerous benefits to both students and faculty; it can also help institutions save time and costs through more efficient administrative processes. A strategic plan is necessary for DT in higher education to design and implement integrated systems that provide analyzed data for decision makers. DT is not a project or initiative but a sustainable culture that exploits digital techniques and tools to empower the university to achieve its strategic goals. The DT strategy should translate the university's vision, mission, goals, and objectives into a smart digital university [22].

DT is the process of integrating digitized data and developing new applications and workflows, leading to new business models. This is a result of the growing use and expansion of digital technologies, which have set the trajectory for fulfilling the goal of DT. DT is different from digitization and digitalization, with digitization being the transformation of data from analog to digital, and digitalization being the process of using digital data to improve workflows. DT is a complex process that involves the conversion of analog data into digital data and has led to contextual shifts that have disengaged students from learning and self-development [23].

DT brings about new challenges to modern society, and institutions of higher education need to prepare students with the necessary competencies and skills to face these challenges [24].

DT is the creation of a new organization's identity or the enhancement of an existing one using technology. It involves changes in structure, strategy, and technology to respond to the needs of a digital environment. DT strategies focus on product and process transformation as well as other organizational issues through the use of new technology. DT involves multiple dimensions, including strategy, leadership, the market, operations, people and skills, culture, governance, and technology. DT enablers include innovative organizational culture, internal and external collaboration,

strategic embeddedness, digital leadership, digital platform structures, bimodal IT structures, institutionalized innovation processes, individual creativity and innovative capabilities, and ICT literacy [18].

DT is an evolutionary process that leverages digital technologies and capabilities, resulting in value-generating business models, advanced and efficient business practices and operations, and improved service delivery. Higher education institutions have embraced new technologies and transformed their practices, business models, and processes to remain relevant in the digital era. DT in HEI concerns the development of new, more advanced, and effective methods and practices in pursuit of higher education missions. HEI struggle to integrate digital technologies into existing practices and processes. DT in HEI involves more than just adopting advanced digital technology; it requires transforming existing teaching and learning models to survive and sustain a competitive position. Leaders in higher education have identified four main goals: improving students' learning environment, increasing operational efficiency, increasing computing power for research, and stimulating innovation in education. The COVID-19 pandemic has pushed HEI to digitally transform to sustain their businesses. Effective professional development and continuing coaching must be provided to educators to help them use their skills and techniques to meet student requirements. DT can be applied to several dimensions of the higher education system, including teaching, pedagogy, learning, curriculum, infrastructure, and administrative and management [17].

DT is an ongoing process expected to result in significant changes in the current business model of HEI. DT is likely to create tensions in the current resources and capabilities base, driving significant tensions that need to be effectively managed. The connection between DT and business models has been established, but more research is needed to understand the role of DT in business model innovation. DT is considered both positive and necessary and an opportunity to professionalize the HEI and better satisfy students' needs and digital expectations. HEI feel pressure to constantly adopt new technologies and processes to remain relevant players. DT affects all university missions, making it challenging to involve different stakeholders, students, staff, and faculty in the process. DT is inevitable and brings tensions to HEIs. DT will transform HEI sectors, and HEI managers need to lead Business Model Innovation (BMI) to position the university as a relevant player in the future. A more disciplined and systematic approach to BMI could be a way to overcome the tensions brought about by the digitalization process. DT influences the business model and requires a new rationale. The dominant rationale for traditional business models is a barrier to DT. Research has identified barriers and enablers of digital business model transformation, but the challenges and tensions involved in DT have been little explored. DT is necessary for HEIs to remain relevant. HEIs must adapt to

technological changes and implement new digitally relevant technologies. DT impacts professors, students, and the academic digital gap and requires the development of digital skills [25], [26].

HEIs play a crucial role in the digital development of a region. Key challenges of DT include cultural and behavioral resistance, lack of a change-oriented mindset, lack of understanding of digital trends, and low functional collaboration. The use of technology in education is a competitive and innovative strategy that facilitates access to higher education and promotes students' success. Digital technologies, such as web tools and social networks, promote communication between students and teachers and can be used in face-to-face and distance education. HEIs must adapt to a dynamic and technological environment, ensure formative quality, and use learning analytics to address the issues of student progression, experience, and satisfaction [27].

D. LEADERSHIP, ORGANISATIONAL CULTURE, AND DIGITAL TRANSFORMATION

Leadership is significant in the successful implementation of DT, and organizational culture is an influential factor. DT leadership (DTL) affects organizational agility, and leaders must be oriented toward task achievement as pioneers of digitization. Digital culture should be seen as a new form of culture in which the use of digital technology has become a lifestyle and long-lasting habit [9].

DTL revolves around function-based leadership in which leaders assume the role of change agents within the digital landscape. DTL drives organizational change by strategically implementing digital technologies and methodologies, which demand a higher-level understanding of the importance and application of these technologies. Effective DTL involves willingness to take calculated risks, experiment with innovative ideas, and navigate the evolving digital landscape while fostering a culture of innovation. Digital leaders collaborate with various stakeholders to identify emerging trends and technologies and develop innovative solutions that enhance an institution's reputation and relevance. Digital leadership involves adopting effective digital practices, providing access to cutting-edge tools and technology, and encouraging cross-functional collaborations. DTL predicts digital self-efficacy, which, in turn, affects digital agility. The factors affecting digital agility in higher education include DTL, digital self-efficacy, and internal branding [19].

Transformational leadership enhances followers' trust, morality, and self-sacrifice and is positively related to DT. DTL involves applying existing digital strategies to SMACIT technologies to generate new value for both leaders and followers. Transformational leadership greatly enhances institutional innovation absorption capability. Transactional digital leadership involves exchanging assurances, reaching agreeable compromises, and recognizing and rewarding satisfactory attempts. Leadership has a direct effect on

the results of the change, including followers' educational engagement, commitment, perceptions, and involvement. DTL significantly affects learners' development and training. Leadership is positively related to educational (work) engagement. Effective leadership within a digitally transformed HEI field is urgently needed for institutional members and representatives to adapt to the continuously changing demands and opportunities. Leadership is the core element of gender, racial, ethnic, religious, and age diversity and inclusion within a highly institutionalized context [23].

E. FRAMEWORK OF PICOC

PICOC is an acronym used as a framework for developing systematic research questions. Each component of PICOC refers to important elements that must be considered when formulating research questions in a systematic context [11].

- **Population**: This refers to the group of individuals or entities that are the focus of the research. In the context of this study, the population may include students, lecturers, or higher education institutions.
- **Intervention**: This action or strategy is implemented to achieve the desired outcome. Interventions included smart management and smart campus models.
- **Comparison**: Refers to another group or situation that can be used as a benchmark for evaluating the effectiveness of the intervention. This might mean comparing institutions that implement digital transformation to those that do not.
- **Outcomes**: Describing the expected results of the intervention, such as increased operational efficiency, student satisfaction, and improved quality of education.
- **Context**: Providing the background or specific situation in which the intervention is applied, which can affect research outcomes such as local conditions, educational policies, or technological developments.

III. RESEARCH METHOD

A systematic literature review (SLR) is a secondary study designed to discover, analyze, and interpret all available data from primary studies relevant to certain research questions. As indicated by Kitchenham and Charters, the action required to undertake a systematic literature review includes planning, conducting, and reporting the review.

The article search strategy was conducted using Parsifal, an online tool designed to support researchers in performing systematic literature reviews. Parsifal will help with the objectives, PICOC, research questions, search string, keywords and synonyms, selection of sources, and the inclusion and exclusion criteria [11].

A. RESEARCH QUESTIONS AND OBJECTIVES

Research questions can be formulated using the PICOC framework, which stands for "Population, Intervention,

TABLE 1. Summary of PICOC.

Population	Higher Education Institutions
Intervention	Implementation and exploration of smart management and smart campus models
Comparison	HEIs that have adopted smart management/campus models versus those that have not
Outcomes	Relationship between smart campus models and smart management practices
Contex	Explore the relationship between smart campus models and smart management, identify research fields, and classify smart management models

TABLE 2. Digital library.

Source	URL	Article
ACM Digital Library	https://dl.acm.org/	50
IEEE Digital Library	https://ieeexplore.ieee.org/	4
Science@Direct	https://www.sciencedirect.com/	22
Scopus	https://www.scopus.com/	285

Comparison, Outcomes, and Context [11], [28]. Table 1 presents a summary of the PICOC.

Research questions related to DT for institution operations in HEI are formulated as follows:

- RQ1: Understanding the relationship between the smart campus model and smart management in HEI
- RQ2: What research areas related to smart management in HEI already exist?
- RQ3: Identifying which smart management models have been researched by researchers?

The objectives of each RQ is as follows:

- To explore the relationship between smart campus models and smart management in HEI.
- To identify and map the existing research fields related to smart management in HEI.
- To classify and analyze smart management models investigated by scholars in the context of higher education.

B. SEARCH STRATEGY

The following search string was used based on the PICOC analysis, taking into account the word that means the same thing as the search term: *higher education institutions AND (smart management OR smart campus models OR digital transformation)*. The existing search string is then used to search for papers in the digital library, table 2 provides the following digital libraries, and the chosen articles derived from the relevant databases:

Figure 1 shows a comparison of the number of articles published per source. The percentage of papers produced from each digital library source in order of the largest is as follows:

- Scopus (285) = 78,9%
- ACM Digital Library (50) = 13,9%
- Science@Direct (22) = 6,1%
- IEEE Digital Library (4) = 1,1%
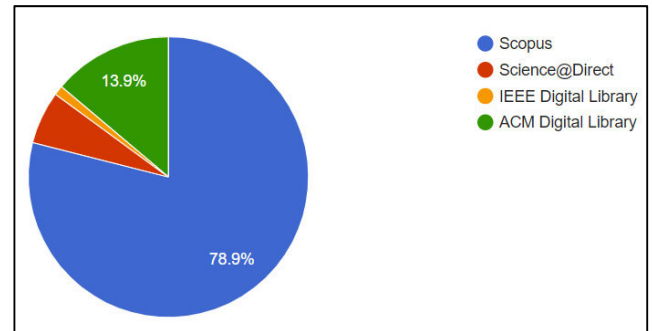
FIGURE 1. Article per source.

TABLE 3. Inclusion and exclusion criteria.

Criteria	Inclusion	Exclusion
Topic	Digital transformation for institution processes in higher education	Digital transformation in field other than institution processes in higher education
Accessibility	Full-text article	Full-text article is not accessible
Publication type	Journal article	Book section, conference paper, data article
Language	Written in English	Article that are not written in English

C. PAPER SELECTION

Review papers were selected to align with the research question. Table 3 shows the inclusion and exclusion criteria.

D. QUALITY ASSESSMENT

Quality assessment evaluates the accuracy and dependability of the selected articles based on a quality framework that delineates their worth according to the established quality levels. According to the literature [11], [29] each article chosen for the systematic literature review (SLR) analysis was assessed based on the assessment criteria questions outlined below:

- Does the article explain the research goals in detail?
- Is there a research background and context in the article?
- Does the article include similar work from earlier research to demonstrate the key contribution of this study?
- Is the model, components, technology, and dimensions clearly described in this article?
- Does the article come to any conclusion related to the study questions or goals?

IV. RESULT

After conducting a systematic literature review of the selected papers, we summarized the results for the research questions discussed:
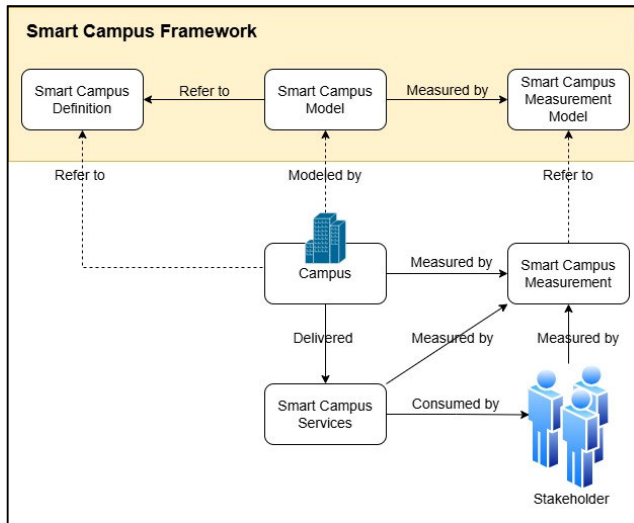
FIGURE 2. Smart campus framework [6].

FIGURE 3. Garuda smart campus model [13].

A. UNDERSTANDING THE RELATIONSHIP BETWEEN THE SMART CAMPUS MODEL AND SMART MANAGEMENT IN HEI (RQ1)

According to Imbar, the smart campus model is a part of the smart campus framework. The smart campus model comprises smart tridharma, smart management, and smart living. Smart management is a part of the smart campus model [6].

Figure 2 shows the smart campus framework, which consists of the definition of a smart campus, a smart campus model, and a smart campus measurement model. The framework was designed to help Indonesian HEIs plan, prepare, and implement smart campuses according to their needs. The framework proposes a definition for a smart campus that focuses on the operation of a smart system within every service provided by the campus. It emphasizes the utilization of existing resources to solve campus challenges and problems by providing smart services that improve the quality of life of all stakeholders [6].

Another study proposed the Garuda Smart Campus Model (GSCM) developed by the Smart City Community and Innovation Center (SCCIC) Bandung Institute of Technology to be used as a reference model for universities to implement smart campuses that can help them improve their competitiveness, achieve their goals, and provide a better learning experience for their students. GSCM comprises three layers: resources, enablers, and services [13]. These studies argue that smart management, which includes applications for human resources, asset management, procurement, finance, and dashboards, is an essential component of the smart campus model. This smart management system should be integrated into GSCM to ensure that HEIs are able to effectively manage their resources and operations.

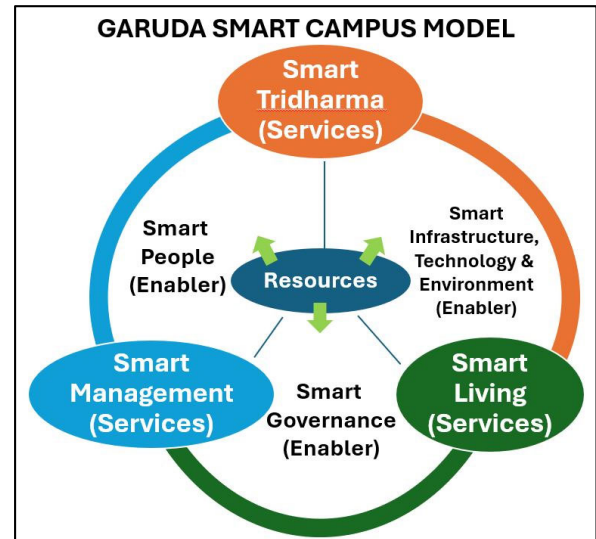Figure 3 illustrates GSCM, which is a conceptual framework for developing a modern, technology-driven educational environment. The model is divided into three main domains, each representing one aspect of a smart campus: smart tridharma, smart management, and smart living. The significance of this model lies in its comprehensive approach to integrating technology into various aspects of campus life, aiming to enhance education, streamline management, and improve the overall living standards of students, faculty, and staff [13].

The development of research conducted by Imbar emphasizes how the smart campus model aims to optimize the three pillars of tridharma (education and teaching, research, and community services), management services (quality assurance, governance, human resources, and cooperation), and living services (finance and infrastructure) [30]. This model is achieved through strategic action that involves a guideline for moving from the current campus situation to the desired campus, aligning with the university's vision, mission, and goals. Supportive action from management is crucial to realizing the objectives of this strategic action, and its success depends on the achievement of operational objectives. This relationship emphasizes the key role of smart management in realizing the goals of the smart campus model, optimizing resources, and ensuring efficient operation within HEIs [30].

Figure 4 shows the smart campus model that integrates the accreditation criteria of the national higher educational standards. The model aims to improve the quality of campuses, increase the value of accreditation, and help achieve a university's vision, mission, and goals [30].

The existing literature provides evidence of this relationship, illustrating that a smart campus model includes components such as smart management, which improves educational outcomes and enhances operational efficiency. The smart campus framework comprises of smart tridharma, smart management, and smart living services.
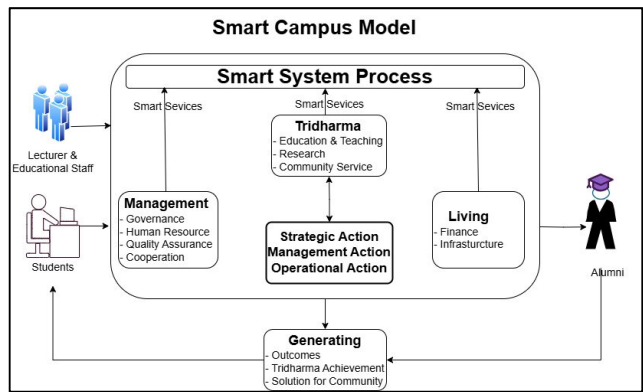
FIGURE 4. Smart campus model [30].

This suggests that smart management is indispensable for successful implementation of the smart campus model [6]. Furthermore, the Garuda Smart Campus Model research corroborates this assertion by emphasizing the ways in which strategic management practices improve the overall learning experience and exacerbate competitive disadvantages [13].

The correlation between the smart campus model and smart management in HEIs demonstrates a synergistic interaction, wherein the adoption of smart management practices improves the operational efficiency and adaptability of smart campus projects. Institutions implementing integrated smart management frameworks are more inclined to enhance stakeholder engagement and resource usage, resulting in improved educational outcomes and promotion of an innovative culture.

B. WHAT RESEARCH AREAS RELATED TO SMART MANAGEMENT IN HEI ALREADY EXIST? (RQ2)

Table 4 shows a summary of smart management in HEI.

Research domains concerning smart management in HEIs already exist, including a variety of services and functions designed to improve operational efficiency and stakeholder involvement. The identified key areas are human resource management, governance services, and institutional collaboration, which together enhance administrative efficiency. The incorporation of intelligent technologies enhances smart finance, asset management, and procurement, thereby improving resource allocation and decision making. The integration of knowledge management as an essential element enhances the advancement of smart campuses, which utilize technologies such as the Internet of Things (IoT) and big data analytics. This study underscores the complex approach necessary to enhance smart management practices in higher education institutions, stressing the importance of new solutions that correspond to the changing requirements of the educational environment.

The current study domains in smart management are enumerated in Table 4, which encapsulates many investigations and evidence. The identified study areas encompass

TABLE 4. Overview of smart management in HEI already exist.

Ref	Smart Management in HEI Already Exist
[6]	Research areas related to smart management services consist of managing human resources, governance service, stewardship service, and managing institutional co-operation. Living services consist of financial service and provide infrastructure to improve the quality of services for stakeholders.
[13]	Smart Management concentrates on administrative and operational functions. Includes Smart HR Management, Smart Finance, Smart Asset Management, Smart Procurement, Dashboard System, Project Management, and Smart Meeting. Smart living services include room access, parking, and payment Aims to streamline campus management through digital solutions.
[14]	Knowledge Management (KM as a critical component of smart campuses (SCs). It explores the role of KM in supporting SCs, analyzing its components, processes, and systems. Smart Campus (SC) Implementation Areas: SCs are implemented in HEIs, including smart governance, smart people, smart mobility, smart environment, smart living, smart education, and smart economy. Technology Components: The document explores the technology components essential for building SCs, including the Internet of Things (IoT), big data, social network applications, mobile and ubiquitous computing, cloud computing, and integration systems.
[20]	Development and implementation of a smart and sustainable campus model within a higher education institution. The areas explored include Internet of Things (IoT) integration, Application-Oriented Architecture (AoA), FIWARE platform, Data management & analytics, and Sustainability.
[19]	Focuses on exploring the relationship between Digital Transformation Leadership and Digital Agility within higher education institutions.
[30]	The development of a measuring tool to assess the level of smart campus in higher education institutions in Indonesia. This tool incorporates smart campus models that integrate the tridharma of higher education with management and living services, measuring the "smartness" of the campus based on three perspectives: anthropocentric, systemic, and technological.
[16]	An identification of strengths, weakness, opportunities, and threats (SWOT) factors remains imperative for enabling a successful Smart Campus transition. The absence of a structured approach for analyzing the relationships between these SWOT factors and the influence thereof on Smart Campus transitions negate effective implementation. This study leverages a systems thinking approach to bridge this gap.
[18]	The paper introduces an integrated model for assessing the level of digital maturity in organizations, including universities. The model considers multiple dimensions, such as digital strategy, leadership and culture, market digitalization, strengthened logistics, and dynamic and digital capabilities. The paper also discusses the challenges universities face in adapting to the digital age, including resistance to change, inadequate leadership, and a lack of financial resources. The insights provided in this document can be used as a foundation for further research into smart management practices in higher education institutions. For instance, researchers could explore how to leverage digital transformation to improve efficiency, effectiveness, and student satisfaction in universities.

Smart HR Management, Smart Finance, and Smart Asset Management [13]. Knowledge Management (KM) is an essential element of smart campuses [14], together with the advancement of sustainable campus models that incorporate IoT and data analytics [20], exemplifying extensive research

efforts focused on enhancing management practices in Higher Education Institutions (HEIs).

The literature reveals a diverse array of research topics on smart management in HEIs, such as stakeholder involvement, technological integration, and organizational change. The significance of digital transformation in enhancing administrative operations, development of intelligent infrastructure, and influence of data analytics on decision-making methodologies are among the most prevalent themes. This breadth of study highlights the critical need for comprehensive models that can handle the multiple issues encountered by education institutions in their digital initiatives.

C. IDENTIFYING WHICH SMART MANAGEMENT MODELS HAVE BEEN RESEARCHED BY RESEARCHERS? (RQ3)

After conducting a comprehensive literature review, the author summarizes the smart management models that have been researched in several documents, as presented in Table 5.

The investigation of smart management models that have been researched uncovers a diverse array of frameworks and approaches designed to improve institutional efficacy and flexibility. Several models have been recognized, including the Smart Campus Framework, which incorporates intelligent management and measurement elements, and the Capability Maturity Model (CMM), which evaluates readiness for digital transformation. Moreover, scholars have suggested strategies that emphasize knowledge management, leadership in digital transformation, and application-oriented architecture for sustainable campuses. These varied methods highlight the necessity of a systematic approach to intelligent management, allowing higher education institutions to maneuver through the intricacies of digital transformation while promoting innovation, enhancing operational efficiency, and improving stakeholders' overall educational experience.

The evidence of smart management models can be found in Table 5, where various models have been researched. For example, the study of a smart-campus framework distinguishes between a smart-campus model and a measurement model [6]. Moreover, the Capability Maturity Model (CMM) serves as a framework for assessing preparation for digital transformation, providing a structured methodology for comprehending maturity levels in higher education institutions (HEIs) [9]. Moreover, analyses of Knowledge Management frameworks underscore their facilitation of the smart campus model, providing further evidence of diversity among the examined models [14].

A variety of smart management models have been suggested and examined in the context of higher education institutions, including GSCM and other frameworks that emphasize digital governance and resource management. These models highlight the amalgamation of technology with educational methodologies to enhance service delivery, operational efficiency, and sustainable academic ecosystems. The literature indicates that the implementation

TABLE 5. Overview of smart management models have been researched.

Ref	Smart Management Model
[6]	Designed a smart campus framework which consists of a smart campus model and a smart campus measurement model
[13]	Model Campus: Value Creation from Living Knowledge, Smart System Model, Garuda Smart Campus Model
[14]	Knowledge Management Solution & Foundation, APO Framework Knowledge Management Performance, Smartness levels for smart university, Knowledge Management as foundation of smart university, The characteristics and KPIs of the SC, Smart campus areas, Smart Learning Communities, intelligent campus themes, main distinctive sub-components of Smart university, Indonesian Government Knowledge Management Model
[20]	Application-oriented Architecture-AoA which is being implemented at the IPVC Smart & Sustainable Campus
[9]	The Capability Maturity Model (CMM) as the best model for measuring organizational maturity, which can be used to assess the maturity level of digital transformation readiness in higher education institutions (HEIs)
[15]	Conceptual framework of Technology-Integrated
[19]	The connection between DTL, digital self-efficacy, and internal branding
[30]	Researches and evaluates a smart campus model and smart campus measurement matrix, which include smart tridharma, smart management, and smart living
[16]	The development of a Smart Campus transition framework using a systems thinking-SWOT analysis approach. The framework is a tool to be used by policy makers, academics, and implementers within the global Higher Education Institution (HEI) landscape for managing successful Smart Campus transition
[23]	Two smart management models: transformational and transactional leadership
[18]	Digital transformation models. Several different models are analyzed and discussed, including models of IT maturity, e-readiness, and digital maturity. The paper also examines the concept of digital transformation, which is defined as a process that leverages digital capabilities and technology to create value.
[17]	The need for higher education institutions to implement digital transformation and the various frameworks and models that can help them achieve it. Three models proposed by top firms: KPMG, Google, and Microsoft
[25]	The impacts of digital transformation (DT) on a higher education institution's (HEI) business model innovation (BMI). The paper explores how DT affects the different dimensions of the HEI business model, including value creation, value proposition, and value capture, and examines the tensions and solutions arising from these transformations.

of these models depends significantly on institutional commitment and well-defined digital transformation strategies.

D. CHALLENGES, OPPORTUNITIES, AND LIMITATIONS

Table 6 summarizes the challenges and opportunities explained in each paper.

This study identifies several limitations that can be addressed in future studies on smart management in HEIs. First, there is a lack of empirical studies validating the proposed smart management models in real-world settings, which necessitates case studies to assess their

TABLE 6. Overview of challenges and opportunities.

Ref	Challenges And Opportunities
[13]	The challenges of higher education in the era of industrial revolution 4.0 include global competition and technological progress. Universities must adapt to the fourth industrial revolution to remain competitive and attract new students. Implementing a smart campus can help universities improve their quality, competitiveness, and international outlook. Future work includes defining criteria, indicators, and implementing the model by taking measurements to several universities in Indonesia.
[14]	Several challenges and limitations, including the human capital gap ratio, knowledge gap, organizational culture, leadership, monitoring and evaluation, and lack of IT infrastructure. Future research is recommended to explore the causal relationship between components and sub-components of KM and to develop a more comprehensive KM model.
[22]	Institutions can improve by developing digital skills and competencies for faculty and staff through ongoing training and professional development. Greater collaboration and partnerships with industry and other institutions can help share best practices and leverage shared resources. Non-digitalized institutions can start by assessing their current state, identifying strengths and weaknesses, and developing a roadmap for digital transformation. A comprehensive approach to digital transformation involves all stakeholders, prioritizes the institution's core mission and values, and continuously evaluates and adapts digital strategies. Partnerships and collaborations with other institutions, industry, and government agencies can facilitate digital transformation.
[19]	The findings have practical implications for stakeholders, including the need for leadership competencies training, investments in enhancing self-efficacy, and clear communication of shifts in values and objectives.
[16]	Universities in developing countries have been reluctant to engage with Smart Campus transitions due to a lack of knowledge on the subject. Relevant literature detailing procedures for enabling these transitions within universities is lacking. The study's framework is transferable to other contexts, but additional research is needed to establish the areas needed to meet local context.
[18]	Digital transformation can be challenging, with a high rate of failure (87.5%) due to unrealistic expectations, limited scope, and poor governance. Success factors include familiarity with home office practices, availability and maturity of technology, and not needing to convince people that a change is necessary. DT objectives need to be precise, realistic, inclusive, succinct, and measurable.
[17]	Higher education institutions face significant challenges in adopting digital transformation, including the need to change and modify existing systems, processes, communication modes, and channels. Digital transformation requires the adoption of digital tools and technologies to innovate and improve service delivery and education systems. There is a need for higher education institutions to consider digital transformation at a macro level, considering all areas where digital technology can be adopted to improve the education system. Prioritization: Universities tend to focus on urgent matters rather than important ones and lack a prioritization plan for digital investments. Decentralized Decision Making: Decentralized decision making can cause delays in the implementation of large-scale decisions and projects. Human Resistance to Change: Resistance to the adoption of digital transformation can be a major obstacle, and academic professionals may oppose change if it threatens job security.

TABLE 6. *(Continued.)* Overview of challenges and opportunities.

	Gaps in Digital Tech Talent: The low level of digital literacy of faculty is a major challenge, and there is a need for faculty training to adapt to new teaching methods and learning tools. Narrow View of ROI: Higher education institutions usually make errors in calculating the business case and ROI for investment in digital transformation.
[27]	The main motivations for companies to adopt digital transformation are customer contact, process optimization, information collection, control, cost reduction, and competitiveness. The main challenges are cultural and behavioral resistance, lack of change-oriented mindset, and lack of understanding of digital trends. Other challenges mentioned include slow evolution of the digital transformation process, lack of investment, and employee training.

transformation [18], strategies to overcome this resistance remain underexplored [17]. There is also a need for comprehensive assessments of the impact of smart management on student outcomes and institutional performance, along with the development of metrics for evaluation [16]. Furthermore, the influence of organizational culture and contextual factors on the adoption of smart management practices has not been thoroughly examined, highlighting the need for research in this area [18]. Lastly, as technology evolves, understanding how emerging technologies, such as artificial intelligence and blockchain, can be integrated into smart management frameworks presents another critical gap for future exploration [25].

V. CONCLUSION

The research findings emphasize the comprehensive aspects of the smart campus model, which includes smart tridharma, smart management, and smart living, offering a structured framework for Indonesian HEIs to improve their operational efficiency and stakeholder engagement. GSCM provides a framework for the integration of smart management practices, emphasizing human resources, governance, and institutional collaboration, while utilizing technologies such as IoT and big data analytics. This comprehensive strategy improves resource allocation and decision-making while adhering to national accreditation criteria, ultimately improving the quality of education and campus life. By leveraging advanced technologies and fostering a collaborative environment, GSCM enables universities to achieve their strategic goals, while ensuring sustainable development.

Adopting new frameworks allows higher education institutions to efficiently manage digital transitions, providing an adaptive and competitive educational environment that is responsive to the changing demands of the academic landscape. These results suggest that smart-management practices are essential. The review emphasizes the necessity of a structured approach to analyze the interplay between the challenges encountered by HEIs in the digital transformation process and the various smart management models and frameworks that have been proposed.

effectiveness [18]. Additionally, while resistance to change is recognized as a significant barrier to digital

This research revealed that the adoption of GSCM in several Indonesian HEI resulted in notable enhancements in resource management and institutional collaboration. Data obtained from a systematic literature review revealed that institutions utilizing smart management practices, such as IoT technology and big data analytics, observed enhancements in student learning experiences and improvements in academic performance metrics relative to those that did not adopt these practices. Consequently, subsequent research should focus on executing case studies in diverse institutions that have implemented GSCM to directly evaluate its impact on student outcomes and institutional efficacy. Through the examination of these case studies and practical applications, the impact of these models on graduation rates, student evaluations, and satisfaction levels within a progressively digital campus environment, thereby enhancing digital strategies to address the distinct requirements of HEI in Indonesia while recognizing challenges in the comprehensive digital transformation process.

This research underscores notable deficiencies, especially in empirical investigations that substantiate the efficacy of deployed smart management models in practical environments. Future research should concentrate on executing case studies and practical applications to evaluate the influence of these models on student outcomes and institutional efficacy. Moreover, mitigating resistance to change via specialized training programs for teachers and staff can foster an environment favorable to digital transformation. By emphasizing these domains, HEIs in Indonesia can augment their preparedness for technological integration and, ultimately, elevate educational quality and competitiveness.

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