Smart university implementation in higher education to improve the graduates' competitiveness

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Abstrak: This research aimed to implement a smart university to optimize the three higher education principles aka Tri Dharma Perguruan Tinggi (Education Dharma, Research Dharma, and Community Service Dharma). A strategic step that can be taken is to apply digitalization to increase the selling value of universities in the education industry and increase the usefulness of the satisfaction of lecturers and students. The research is exploratory qualitative using interviews, observations, and literature studies as data collection techniques. The sampling method used was non-probability sampling (purposive sampling). The findings show that several supporting factors that influence the optimization of the three principles of higher education are the flexibility of the workplace and time, as well as the use of information technology which is easier to use and has high accessibility. Facilities and infrastructure are supporting elements. The hardware and software infrastructure condition in universities is still inadequate to support a quality learning process. Universities need to improve the performance of educators and education staff..

Keywords: *higher education, smart university, Tri Dharma*

INTRODUCTION

The rapid development of digital technology has led to many changes in daily life that cover almost all aspects of life, including university services. The application of digital technology requires universities to adapt to the times and operate more effectively and efficiently (Dong, Zhang, Yip, Swift, & Beswick, 2020, p. 46). This result is in line with Kariapper (2020, p. 4622), which states that the strategic role of digitalization technology is to solve the gap in the quality of educational resources and learning models that are less relevant so that universities can improve the quality of their competitive graduates. Efforts to utilize this digital technology must be supported by the accessibility of its users to connect to the internet access. According to data from Nuzzaci and La Vecchia (2013, p. 19), internet usage penetration in Indonesia is 176 million people or 64 percent of the total population of Indonesia. The growth population accessing the internet has seen significant growth in the last year, reaching 25.3 million or 17 percent of new internet assessors. This figure shows Indonesia's position in the top three, behind China and India. Observing the number of internet users who have increased significantly, one can easily carry out routine activities in real-time without being hindered by place, time, and space. It indicates that geographical boundaries are disappearing due to the existence of the internet (Glisson & Chowdhury, 2020, p. 159).

Along with technological development, people's lifestyles and working habits have undergone a tremendous transformation and ways of learning. The gradual change in the learning environment and the increasing demand for personalized and adaptive learning have pushed the reform and development in education. As the high-end form of a smart education system, the smart university came into reality and has received more and more attention worldwide (Siswanto, Kartanagara, & Chuan, 2021, p. 79). Smart university creates a smart learning environment for the citizens by transforming them into a smart workforce, making it an integral part of the smart city framework. The development and popularity of smart universities also support the knowledge economy. The global smart education market is forecast to grow at a compound annual growth rate of 15.96% between 2018 and 2022. There is a pressing need to perform active research in such a fast-changing domain and obtain a clear understanding of the smart university and its attributes (Bayani, Leiton, & Loaiza, 2017, p. 17751). The development in technology calls for a revolution from the traditional education strategy with predominantly face-to-face teaching/learning into a more innovative way that promotes new education paradigms. Several terminologies to conceptually describe innovative education have been raised, such as smart classrooms, smart learning environments, smart e-learning, blended learning, and ubiquitous learning (Alwi, Dwiningrum, Suyanto, Sunarto, & Surono, 2021, p. 116). Literature defines and envisages the smart university concerning the smart education revolution. For instance, a vision for developing an intelligent university is provided. The design and development of an innovative learning environment are explored. The blended learning concept and its applications in the smart university are covered (Nachandiya, Gambo, Joel, & Davwar, 2018, p. 5).

Information and Communication Technology (ICT) development encourages various educational institutions, especially universities, to use the internet to manage education. With the internet, universities can improve the quality of graduates who can compete at national and international levels (Baptist, Utami, Subali, & Aloysius, 2020, p. 62).

Higher education is a continuation of secondary education to prepare students to become community members with academic and professional abilities in applying, developing, and creating science, technology, and the arts. To achieve this goal, legally-formally, universities do not only act as teaching centers because the teaching and learning process carried out in the classroom without being supported by relevant research results will experience setbacks and not develop (Villegas-Ch, Palacios-Pacheco, & Luján-Mora, 2019, p. 24). Higher education as a scientific community must play an active, positive role in solving problems faced by society by producing knowledge that is ready to use, in the sense of a problem finder. Thus, development can use the knowledge gained through research to explain and predict events in people's lives, the business world, and the industrial world (Damayanti, Santyasa, & Sudiatmika, 2020, p. 94). The universities must produce outputs with solid personalities, superior abilities, intelligence, and creativity to compete with other nations in the face of globalization. Therefore, the existence of universities has an important position and function in developing society. The social change process is such immediate demands that the position and function of the university be realized in a fundamental role. The role of universities is contained in implementing the Three Principles of Higher Education: Education Dharma, Research Dharma, and Community Service Dharma (Salvioni, Franzoni, & Cassano, 2017, p. 17-18) is shown in Figure 1.

Figure 1
Three principles of higher education
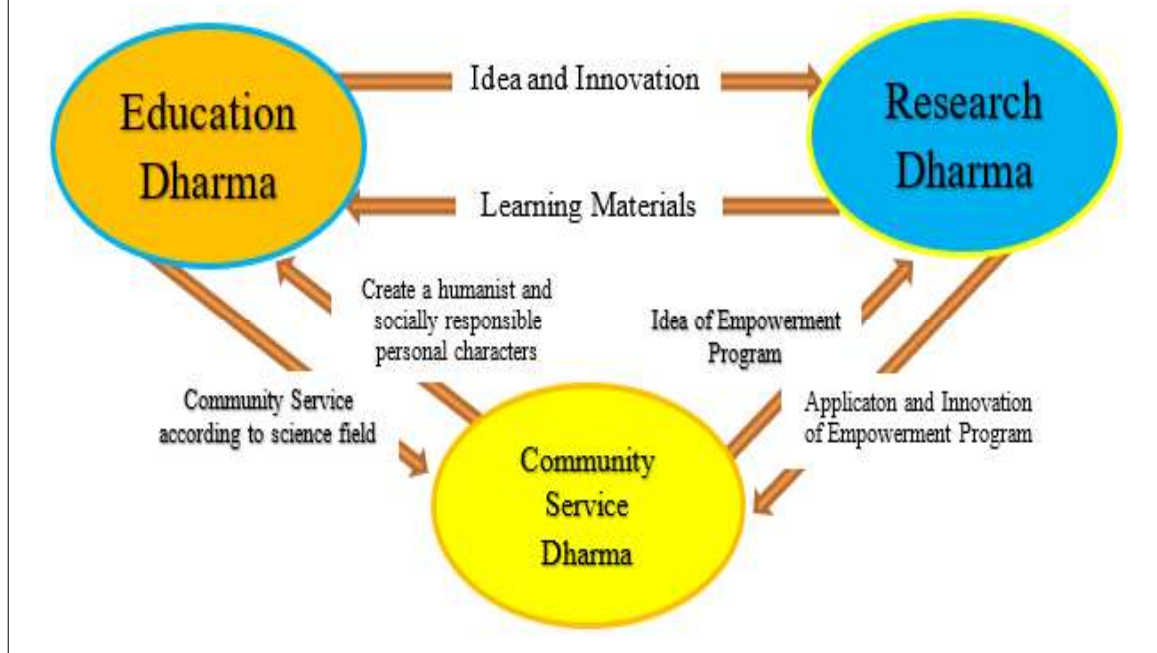
Smart university refers to university facilities that support all activities of the academic community in carrying out the obligations of the Three Principles of Higher Education, using information technology as the backbone of support. Smart university implementation is not easy because it involves many facilities. The miniature implementation of smart university technology has finally emerged, such as smart classrooms, smart laboratories, smart buildings, smart departments, and smart faculty. Implementing a smart university is needed as a development from a conventional or usual university management situation and then switches to implementing a system using technology (Petrovskiy & Agapova, 2016, p. 2527).

A well-developed university can implement the obligations of the Three Principles of Higher Education as a responsibility to science, society, and the environment. The Three Principles of Higher Education obligation to provide education, research, and community service (Marzuki, Zuchdi, Hajaroh, Imtihan, & Wellyana, 2019, p. 283). One of the domains of the Three Principles of Higher Education that may improve service and efficiency using technology in a smart university environment is education. The use of technology helps create creative and innovative students who will lead them to become excellent graduates who are ready to face challenges in today's digital era (see Figure 2). Applying technology systems in the management of the education sector will increase efficiency and stakeholder satisfaction. Education is a conscious and planned effort to create a learning atmosphere and learning process, so the students can actively develop their potential to have religious-spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, and nation-state (Siregar, Lumbanraja, & Salim, 2016, p. 9).

Figure 2
The roadmap of graduates competitiveness expectation
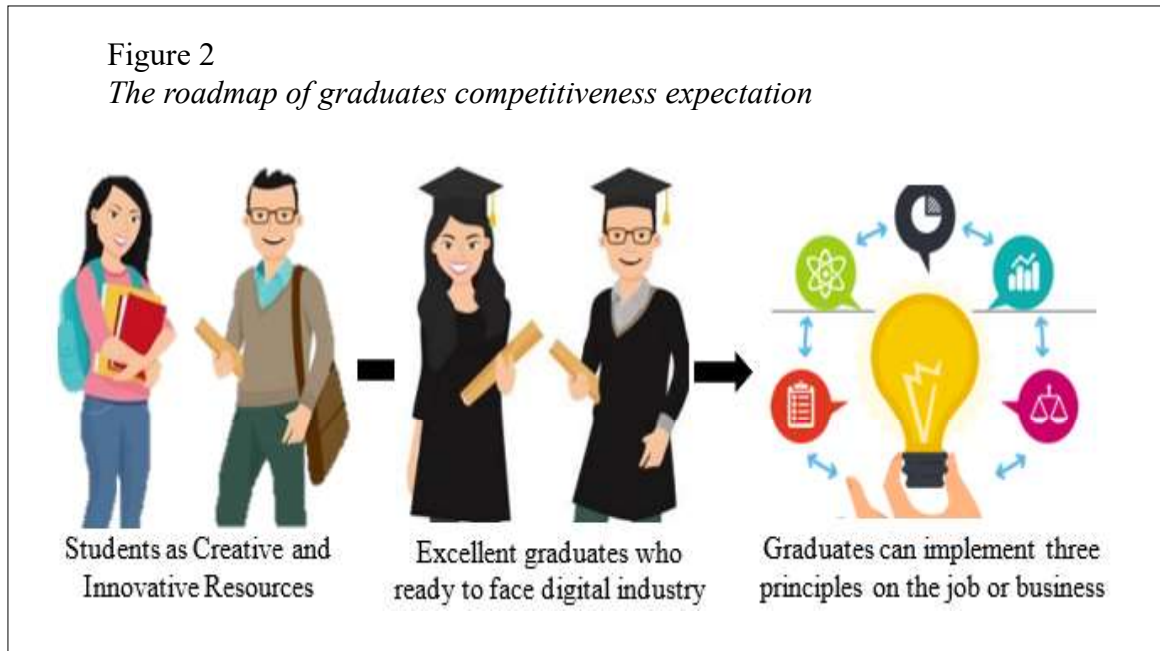
Several component processes must be carried out when implementing e-learning, such as content relevant to the learning objectives, using learning methods, and using media elements such as sentences and pictures to distribute content and learning methods. Learning can be done directly with the instructor (synchronous) or individual learning (asynchronous) and by building new insights and techniques related to learning objectives (Daniel, 2015, p. 911). Blended learning is an e-learning strategy that combines several learning strategies with environmental conditions and learning facilities that allow learning objectives to be achieved optimally. For teachers, lecturers, and practitioners in the field of education, there will be many combinations that can be done, especially by utilizing existing telecommunications tools such as the internet, mobile phones, and other information technology (Agnes, Jola, & Gaspersz, 2018, p. 32). Blended learning can also be viewed as a continuum from conventional face-to-face to entirely online thus there are several forms of blended learning continuum, including entirely online, where there is no face-to-face at all; entirely online, but there is an option to do face-to-face even though it is not required; mostly full online, but certain days are done face to face either in class or in the lab or the workplace directly; mostly entire online, but students still learn conventionally in class or lab every day; primarily conventional learning in the classroom or lab, but students are required to take part in certain online activities as enrichment or addition; entirely conventional learning, although there are online activities even though it is not required for students to follow them; and entirely conventional learning (Prima, Ganefri, Krismadinata & Saputra, 2019, p. 4).

Internet of things (IoT) is a development that can optimize human life with the help of sensors and artificial intelligence that uses the internet network to carry out commands and connect humans with devices. A concept that aims to expand the benefits of continuously connected internet connectivity. An object is the IoT if it is contained in an electronic object or any equipment connected to a local and global network through embedded sensors and is permanently active (Winarti, Rahmini, & Almubarak, 2019, p. 181). IoT works by utilizing

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a programming argument in which every command of an argument produces an interaction and communication between machines that are connected automatically, and the media that connects these devices is the internet (Uskov, Bakken, Karri et al., 2018, p. 5).

IoT can create a complete internet environment and make it easier for people to access various smart technologies integrated with automation that can be used anytime, anywhere. IoT has three main characteristics: objects with devices/measuring devices, interconnected autonomous terminals, and intelligent services.

IoT is implemented in education, which plays a role in teaching institutions and updating the learning system into m-learning and e-learning. The application of IoT in the learning system starts with the help of various devices such as gadgets, tablets, e-book readers, and social media. With the help of the internet, students get information and knowledge through devices connected to the internet (Tenekeci & Uzunboylu, 2020, p. 13). The development of the learning system aims to improve the quality of student learning and the ease of learning, for example, in general, if students cannot keep up with the pace of learning or are unable to attend classes, students will be counted behind in lessons. Applying IoT in the learning system allows students to get lessons quickly (Tenekeci & Uzunboylu, 2020, p. 14).

The lecturers' duties are professional educators and scientists with the main task of transforming, developing and disseminating science, technology, and art through education, research, and community service. In carrying out their professional duties and simultaneously as scientists, lecturers must have knowledge, skills, and attitudes that must be lived and mastered. In addition to having knowledge, skills, and attitudes as professional educators and scientists in the higher education environment, lecturers must have the competence and carry out their duties, including: professional competence with the breadth of academic insight and the depth of lecturers' knowledge of the scientific material they are engaged in; pedagogic competence with the mastery of lecturers in various approaches, methods, class management, and evaluation of learning following the characteristics of the material and student development; personal competence, namely the ability of lecturers to present themselves as role models and show enthusiasm and love for their profession; social competence, the ability of lecturers to appreciate diversity, be active in various social activities and work together (Uskov, Bakken, Howlett, & Jain., 2018, pp. 56-57).

Research conducted by Mbombo and Cavus (2021) entitled Smart University: A University In the Technological Age showed that big data provides teachers with a large and necessary amount of information about their students to follow up on each student. With detailed mass information about students, the teacher will be able to examine the evolution and engagement of the student in a precise and concrete way in order to help him/her according to his/her shortcoming in terms of participating in courses, completing homework, and the time spent researching in the online library for example. We can also see the benefits that the students will be able to draw, such as the flexible courses allowing them to access it at any place and at any time to his courses. Students can maintain real-time communication with other students or teachers and have the freedom to participate in discussions or scientific forums. The student also has free and unlimited access to study materials and can log in at a time suitable for them. Students experiencing difficulties will benefit from personalized follow-ups that will allow them to improve their intellectual level. The advantages at the educational institute level are not negligible because, with this mass information, it will monitor the evolution of each student individually and closely monitor

how teachers take care of their student's learning. By having accurate information that can be accessed as quickly as possible, it is possible to analyze each student's progress quickly, precisely, and intelligently. The institute can also spend less than a traditional institute in terms of infrastructure.

Research conducted by Ryu, Kim, and Yun (2015) entitled Integrated Semantics Service Platform for the Internet of Things: A Case Study of a Smart Office shows the results of creating an integrated semantic service platform (ISSP) to support ontological models in various IoT-based service domain on a smart campus. Specifically, the authors address three main issues for providing integrated semantic services and IoT systems including semantic discovery, dynamic semantic representation, and semantic data storage for IoT resources. Then develop a prototype service for smart offices using ISSP, which can provide a personalized office environment by interpreting the user's text input via a smartphone. The IoT technology has had a significant impact on universities, which not only changed traditional teaching practices but has also brought changes in the infrastructure of educational institutions. A smart university has many features like smart parking, inventory, lighting, tracking, and smart corridors with data centers for processing all data types to enhance communication and improves smart-university learning. At present, the design and construction of the smart university are still in the exploration stage. Based on the background of the problem above, this study aims to analyze the implementation of the smart university in optimizing the three principles of higher education so that university support programs in implementing smart universities become more comprehensive. The thing that needs to be prepared is integration in implementing the program, ideally to be replicated more easily by the dean in each faculty (Alsheikh, 2019, pp. 32-33).

METHOD

This type of research is exploratory qualitative with interview methods and literature study in data collection. This method was used to identify the implementation of a smart university in optimizing the three higher education principles. The population of this research was all universities in Semarang, with the sampling method using purposive sampling. The criteria determined are the management study program at a private university in Semarang that implements a smart university in implementing the three principles of higher education. The data sources were used to consist of primary data and secondary data. The analysis technique of the smart university implementation program was carried out through data collection, data reduction, data presentation, and conclusion because this method can explain, assess, and visualize the modeling used. Guided interview questions asked to include: How do you find out about smart universities?; What do you do after you get enough information about smart universities?; Are you immediately interested in implementing it?; What made you interested and then decided to implement a smart university?; What are the stages of making a smart university?; and What are the benefits of implementing a smart university?

The concept of a smart university refers to university facilities that support all activities of the academic community in carrying out the obligations of the three principles of higher education using information technology as its primary basis. Smart university implementation is not easy because it involves many facilities that must be realized (Nadeem, Abedin, Cerpa, & Chew, 2018, p. 3). The implementation of smart university technology in miniature has finally emerged, such as smart students, lecturers, administrators, classrooms, laboratories,

smart buildings, smart departments, and faculty (see Figure 3). At several universities abroad, the concept of technology in smart universities is expected to support advanced learning and research and streamline the process of delivering administrative services (Bayani et al., 2017, p. 17750). In addition to improving the quality of on-university education services to students, the smart university concept is also related to efforts to improve the quality of education offered by each university. This is because the smart university concept demands direct implementation of the knowledge learned in university so the success of the smart university concept should be in line with the quality of education delivered in lecturer materials (Komariah, Sofyan, & Wagiran, 2019, p. 211). Digital transformation of the university will direct their services based on technology so the three higher education principles can be achieved more optimally. Many internet-based systems can be applied to universities, and it is possible to implement them for educational purposes (Maciá Pérez, Aciá-Pérez, Berna-Martínez, & Lorenzo-Fonseca, 2021, p. 14).

Figure 3
Smart university implementation model
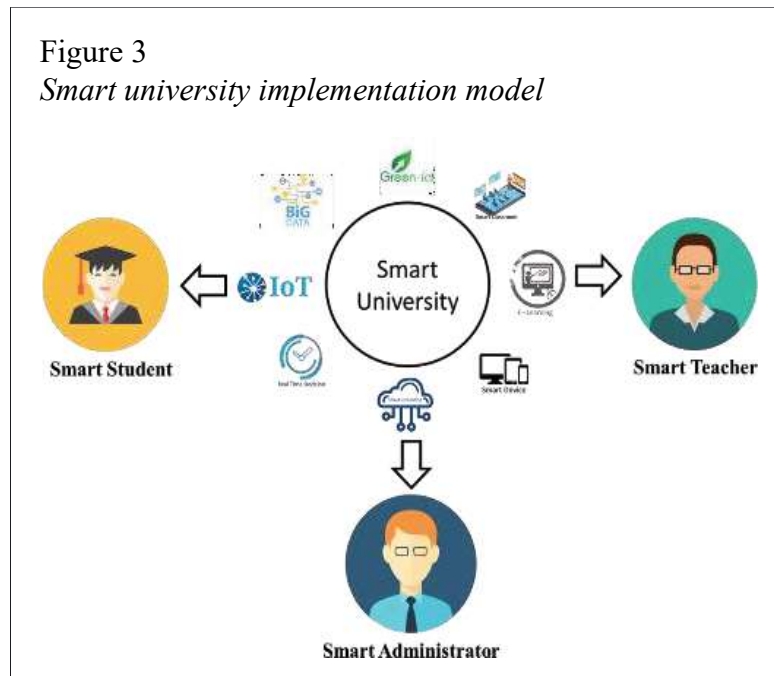
Since the invention of internet technology, almost anything has become possible in the world of education. Currently, students can learn anywhere and at any time with the existing electronic learning system facilities. E-learning is now increasingly recognized to solve education and training problems in developed countries and developing countries, especially Indonesia. Many people use different terms for e-learning, but in principle, e-learning uses electronic services as a tool (El Firdoussi et al., 2020, p. 6). E-learning can be used as an innovative approach to distributing well-designed, learner-centered, interactive learning and facilitating a learning environment for everyone by using the attributes and resources of various digital technologies during the learning material. Suitable for open learning, a flexible learning environment (Ramsden, 2018, p. 366). E-learning also offers new opportunities for instructors and students to enrich the learning and teaching experience through a virtual

environment that supports the delivery, exploration, and application of information (Rico-Bautista et al., 2021, p. 49).

The learning strategy used in e-learning is a blended learning strategy. Blended learning was a learning process that utilizes various approaches. The approach taken was able to utilize a variety of media and technology. With blended learning, the learning process was able to combine various physical and virtual sources. The blended learning strategy can be applied according to the agreed conditions. Blended learning should be seen as a pedagogical approach that applies various learning approaches rather than how big the delivery system is between face-to-face and online (Jubran & Sumiyana, 2016, p. 131). Blended learning should combine wisely, relevantly, and precisely between the potential of face-to-face with the potential of information and communication technology which is rapidly developing, to allow: a shift in the learning paradigm from what was previously more teacher-centered to a new learner-centered paradigm (student-centered learning); an increase in interaction or interactivity between students and teachers, students and students, students/teachers with content, students/teachers with other learning resources; and the occurrence of convergence between various methods, media, learning resources, and other relevant learning environments (Reyna, Hanham & Meier, 2018, p. 42). The schema of technology implementation in developing smart university is described in Figure 4.

FINDINGS AND DISCUSSION

Lecturer performance assessment for the implementation of lectures is based on the success of carrying out lectures according to the schedule set by the study program and

Figure 4
Technology implementation to develop smart university
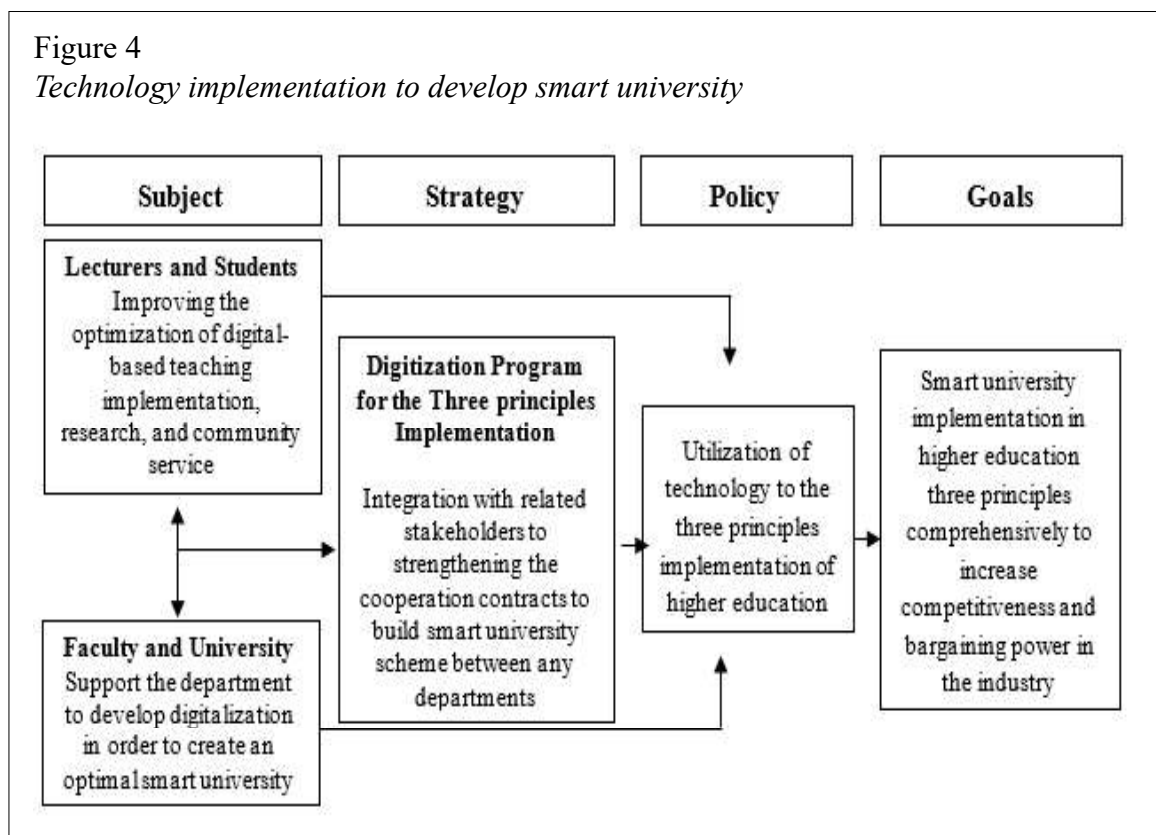
the number of courses taught. The study results show that lecturers can carry out lectures according to their schedules. When implementing a smart university when teaching, the main obstacles are low computer capacity for online learning and poor internet connection. The internet procurement at the lecturer's home is carried out by the lecturer himself so that the internet capacity of each lecturer varies. Besides that, other obstacles are the occurrence of power outages, the lack of examples of learning aids, and the limitations of lecturers in mastering online learning applications. However, the positive side of smart university schemes, namely lecturers save transportation costs and work time efficiently. Lecturers can do household work between academic working hours, increase lecturer creativity in developing learning media and mastery of information technology for online learning, and work in a safe, more comfortable, relaxed working atmosphere.

The smart-university scheme has changed student academic guidance and final project exams from conventional face-to-face to online. The media used for the final project guidance process are whatsapp group, e-mail, google meet, and zoom. Meanwhile, the final project implementation is used by google meet or zoom. Overall, the process of academic guidance and student final project exams runs according to the schedule determined by the study program. The obstacle that arises is the smooth internet connection between students and lecturers. The positive thing about the smart university scheme for academic guidance is that students consult more intensively with their supervisors because there are no distance, place, or time constraints. Likewise, the final assignment exam makes students more comfortable during exams and safe. Students like online learning because it makes them more disciplined in doing assignments and more familiar with information technology.

The successful implementation of lecturer research in the smart university scheme depends on the nature of the data, location, and type of research. Research carried out as planned is in the laboratory, secondary data is obtained online, and experimental research with treatments that do not involve many people. However, research in the field with surveys and data collection with interview techniques to research subjects can be carried out properly because the implementation of research is carried out with health protocols and data collection with the help of colleagues at the research site. As for the research that must be modified, the time and method of data collection due to some problems is research with surveys, and primary data is taken by interviewing resource persons. Field research will experience difficulties, especially in collecting field data. Based on the study, the obstacles that arise in the lecturer's research are that the implementation of health protocols will hinder lecturers' mobility, the limited laboratory use schedule, and the limited collection of data by interview. In contrast, the retrieval of secondary data online is constrained by the speed of internet access to download big data. The positive side of the smart university scheme for lecturer research raises the creativity to overcome field data collection methods safely and effectively. The online methods make secondary data collection more intensive, and discussions between research members are flexible in terms of time, effort, and cost. Lecturers focus more on reading, exploring various sources of information, analyzing secondary data, and writing research reports, and lecturers are encouraged to explore new ideas for solving research problems.

Lecturer's scientific publications can be done in seminar forums, scientific journals, patents, intellectual property rights, designs/models, or textbooks. The performance indicators of a lecturer's scientific publications can be seen from the quality and quantity of his scientific

publications, but the quantity of scientific publications is a general indicator to assess the performance of a lecturer's scientific publications. The positive thing about the smart university scheme in lecturers' scientific publications is to bring up research studies topics and publications to find solutions to problems in the digital era in a more varied manner; webinar model seminars with efficient time, place, and cost; become more focused on writing research reports and publication manuscripts to reputable scientific journals.

The forms of community service include occupying leadership outside the institution, developing educational and research results that are used by the community or industry, training or counseling or upgrading or lectures to the community, and serving the community to support the implementation of development, making unpublished community service works or published in community service journals and play an active role in the management of scientific journals. Based on the existing forms of community service, community service must have direct interaction with the community, and community service does not require direct interaction with the community. In implementing the smart university scheme, some community service has been successfully implemented by lecturers, but some have not been implemented. The lecturers have successfully carried out community service that does not require direct interaction with the community, for example, the involvement of lecturers as reviewers of scientific journals or managers of scientific journals, carrying out the development of educational and research results that are utilized by the community or industry and making community service works that not published or published in community service journals. The positive side of the smart university scheme in community service is to stimulate the creativity of lecturers to look for forms of community service that do not have to interact directly with the community; stimulate the creativity of lecturers to learn to use various social media to do community service.

Education is systemically oriented to graduate competence formulated in a quality loop in which all components can be interrelated in educational activities. The systemic review is described in Figure 5. It covers four scopes of activities. The cycle begins with carefully identifying market desires, which is then followed by the determination of competency standards, which are then used to develop curriculum; the implementation stage of education is planning the teaching and learning process, including determining the qualifications of teachers following competence; the learning stage studies and practice constantly until a certificate of competence is issued and widely circulated to users of educational services; reviewing the suitability of graduates with the competencies required by the market, then taking corrective actions against discrepancies. The on the job assignment is a university that collaborates with industry or companies that can provide real work to its graduates so that the learning process can run and standard work competencies can be met. Attribution theory is concerned with the analysis of the occurrence of interactions in the classroom. In the context of the learning process and in order to improve the ability or competence of students, what needs to be considered is individual differences in potential, such as intelligence, interests, talents, and motivation, and various types of student learning.

In the implementation of policy, several strategies and efforts have been taken that refer to the phenomena that occur in universities in the implementation of the three principles of higher education (see Figure 6).

Strategy-1: Efforts to procure/higher education facilities. The university provides a library, lecturer room, hall, prayer room/prayer room, meeting room/trial room, room for

Figure 5
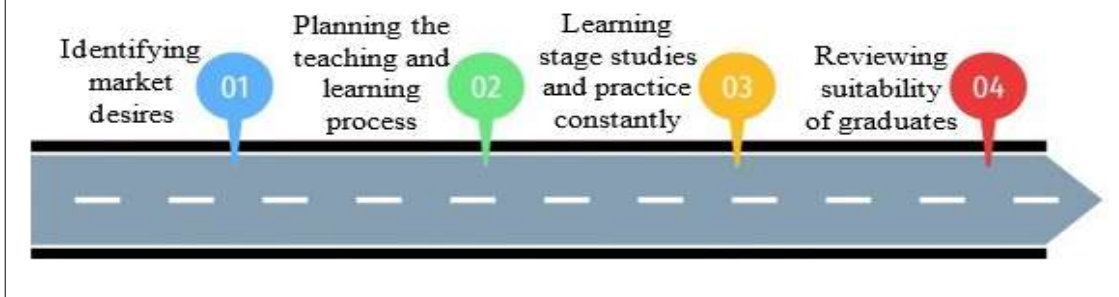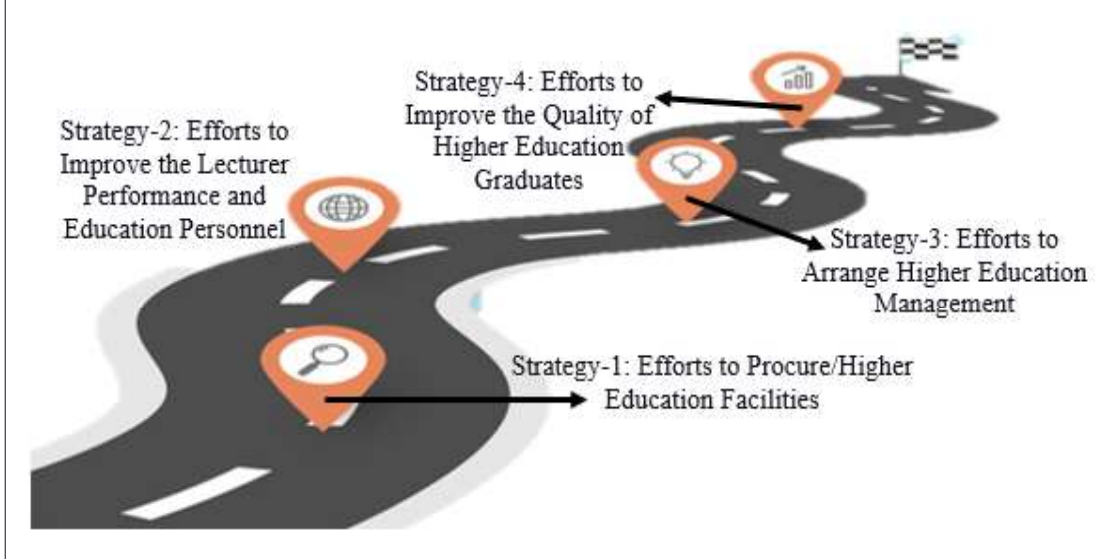*The systemic review covers four scopes of activities*

Figure 6
The several strategies and efforts to implementing smart university

student activities, restroom, pantry, and parking lot. Universities form learning centers that develop the competence and abilities of the academic community. Universities build knowledge management systems and tools to increase the knowledge and insight of leaders, structures, staff, lecturers, and employees. Universities provide work practice facilities to fulfill essential competencies through learning abilities. The university has a database of research results from lecturers and students. Universities have access to scientific journals and digital library materials nationally, so conducting training and socialization for librarians and academics is necessary. The college completes the needs of classrooms, laboratory equipment, workshops, and libraries, including living laboratories. Universities have an effective and efficient management system for facilities and infrastructure by utilizing information technology, including a complete inventory system. The management system also includes a pattern of regular reporting from the implementing unit to the management and can be used as information for users (students and lecturers).

Strategy-2: Efforts to improve the lecturer performance and education personnel. The Ministry of National Education and higher education and related elements are more selective in the recruitment of educators and staff with the required standards of educators and education personnel, namely having academic qualifications and competencies as learning agents, being physically and mentally healthy, and having the ability to realize educational goals national. Universities and related elements organize training that is relevant to the needs of educators and education staff so that they have competencies and abilities according to their fields of work that they can improve the quality of performance of educators and education staff so that they have competencies and abilities according to their fields of work so that they can improve their performance. The quality of the performance of educators and education personnel. Universities and related elements empower educators and education staff by following their competencies and qualifications. Universities and related elements assist with further study costs for educators and education personnel who excel in their work but are economically incapable. Universities give awards to educators and education personnel who excel in their work. Universities have benchmarks for determining professional abilities. Universities review rules/policies that are more flexible to encourage educators and education staff to develop their creativity.

Srategy-3: Efforts to arrange higher education management. Universities streamline the management and utilization of campus facilities and infrastructure. Universities have clear policies, guidelines, and regulations regarding the security and safety of facilities and infrastructure at the institutional level. Evidence of policy implementation must be traceable from more detailed and applicable regulations and periodic reports at the laboratory/studio/ library level and other places where activities are carried out. Universities follow the development of information technology so that all academics are skilled and agile in using information technology.

Strategy-4: Efforts to improve the quality of higher education graduates. Universities and related elements streamline and synergize curriculum content by taking into account the interests and comparative advantages of the region and the development of science and technology. Universities precisely determine local content curricula according to comparative advantage and regional development. Universities develop student programs that are directed so that graduates have a leadership spirit, are highly dedicated, have physical and mental resilience, and always become creatures who serve and are devoted to god almighty. Universities create a climate familiar with information technology to support the progress of the business and industrial worlds. Universities continue to improve and develop their reputation and competitiveness of universities as centers of excellence in the world of Indonesian higher education and overseas. Universities improve the quality of the learning process so that students and graduates have the competence, knowledge, & skills to contribute significantly to the development of the nation and state. In carrying out the learning process, universities must equip students with cognitive aspects and holistically complement them with moral aspects and social responsibility.

CONCLUSION

Building a smart university requires understanding conceptual design and structural analysis from the perspectives of smart technologies. This becomes possible if big data technology elements for storage and analysis are integrated into decision-making within the

confined of an intelligent environment. The construction of a smart university also requires smart devices, networks, smart applications, and cloud computing technology to produce information services and management for an effective university information system. Integrating these related technologies to design a smart university to achieve a sustaining university Information system becomes necessary as many things, including humans, tend to communicate with smart technologies to create a smart and intelligent environment for effective communication and decision-making in a learning environment.

Facilities and infrastructure are supporting elements in implementing the three principles of Higher Education, including buildings, furniture, equipment, and asset and campus security systems. The hardware and software infrastructure condition in universities is still inadequate to support a quality learning process. The performance of educators and education staff has not been optimal due to educators' professionalism and welfare level, and education personnel is not following the challenges of quality improvement. The ability to research lecturers still varies due to the different levels of education achieved by educators and educational staff. Higher education facilities and infrastructure also do not support research activities for lecturers. Higher education management has not been well organized because of the weak commitment of bureaucrats and higher education managers to achieve excellence. In addition, there is a lack of higher education management skills with an increasingly complex spectrum of tasks and educational problems, and there are still higher education managers who do not have educational disciplinary backgrounds. The quality of higher education graduates has not been optimal because there is no synchronization between education policies, the quality of graduates, the industries, and the curriculum for the initiative, creativity, art appreciation, and normative abilities or comprehensive intelligence (holistic), so that morals, character, and tolerance among students decrease and the younger generation. It is rare in tertiary institutions to find workshops that lead to the quality of graduates desired by the user.

This research proposed architecture for manageability and security. In the future, a smart university will be developed based on these layers to understand the applicability and practicability of smart-university. Universities need to improve the performance of educators and education staff, which can be done by allocating research funds so that educators are motivated by research. Managers of higher education are advised to improve their knowledge, attitudes continuously, and skills as well as master the science of education management, change the mindset in the form of new governance following the concept of quality assurance in higher education, prepare adaptive management, and be oriented to the needs of the academic community. Produce outputs and outcomes that meet the community's need for the provision of skilled workers, and universities need to review the curriculum formulation, conduct information gathering from stakeholders, conduct networking with other educational institutions that have implemented quality loops, synergistically collaborate with the industry to produce graduates who become prospective workers who have high professionalism.

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