Smart Campus Development: Trends In Building A Digital-Based Academic Culture In Cyber Learning Environments

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Abstract.

This research aims to formulate the design, roadmap, implementation and impact of smart campus development in higher education in building a digital-based academic culture. This research uses qualitative field research methods with a multi-site study design and flow analysis techniques. The findings of this research show that the smart campus development strategy has a special character in higher education. Smart campus development system design requires data center infrastructure, internet, and building management through Enterprise Architecture (EA) Analysis, Jason with Token (JWT), LemonLDA, and according to user interplace and user experience needs. The smart campus road map was built in a long-term plan towards smart people by relying on sustainable leadership through leadership policies. Smart campus implementation includes smart boards, multi-device gadgets, and campus domain e-mail ownership. The output of smart campus development has an impact on changing mindsets towards smart thinking and ease of serving the academic needs of both national and international students; accountability, transparency, certainty of academic processes and promotions; and compliance with the system.

Keywords: *Smart campus, development strategy and academic culture.*

I. INTRODUCTION

Technological developments and various accompanying applications have had a positive impact on the world of education. Existing technological sophistication can improve the teaching and learning experience at all levels, from primary, secondary to tertiary education. Internet of Things (IoT) based technology is considered a smart solution for all infrastructure [1]. For example, smart solutions in mobilization to improve the quality of life of the population, reduce negative impacts on the environment, and encourage innovation. Technology integration has revolutionized the industry where more and more solutions are being developed to prioritize user convenience. Amazon's Alexa, Apple's Siri, and Google Assistant are some examples that facilitate smart living with great comfort and convenience [2]. Today, IoT, big data and artificial intelligence are also widely used in campus environments, which are then called smart campuses. The concept of smart is not limited to one object only, but extends to larger objects such as smart homes, smart cities, smart campuses and others that have the ability to have a significant impact on intelligence. [3].Smart campus is a new trend that allows an educational institution to combine technology with infrastructure [4]. Smart campus is an effort to improve responsive, intelligent and quality services. Smart campus development is a relevant way to simplify all aspects of campus life. Especially in the era of Industrial Revolution 4.0, the existence of IoT is able to make the connection of various systems faster, better quality and more economical [5]. Smart campus refers to the integrated integration of campus life supported by technology [6]. The adoption of a smart campus is an evolution from conventional management to a technology-enabled campus, although its implementation is not easy because it involves many arrangements that must be made [7].

Research on smart campuses is also widely carried out in various countries, including Indonesia. For example, the development of contactless technology can provide an easier way to enter data when accessing certain rooms or equipment rather than using a keyboard manually [8]. Likewise with research on smart campus development at one of the universities in Surakarta by developing 24 information systems [9]. The overall results of this research show that the development of a smart campus contributes to simplifying all

aspects of life and also changes the campus academic culture.Smart campuses are often focused on infrastructure development, as an effort to improve service quality. Such as the development of smart campuses in new student admission management systems, academic information systems, and library management information systems [4], [10]. However, in other contexts, a smart campus can be seen as a system that can be used to build a more advanced academic culture. Smart campus can be used to process campus data effectively, so that it is able to predict student learning outcomes and provide support for making decisions [11].In this research, smart campuses are examined in a different focus, namely related to the development of smart campuses to build a digital-based academic culture. Where the digital-based academic culture in this research is viewed from the learning process, services for access to learning resources and integrated facilities to make it easier for the academic community in the education process.

II. METHODS

This research uses a qualitative method with an ex post facto approach which seeks to explore, explain and explore various unique and interesting social facts. [12]. This research aims to obtain an in-depth description of smart campus development strategies in building a digital-based academic culture. Researchers attempt to describe the facts and phenomena that occur at the location accurately and completely, and hope to be able to explain the various phenomena found at the research location [13].Naturalistics is the paradigm in this research, with data from the field interpreted through emic and ethical perspectives, while the type of research used is field research. The setting for this research is the State Islamic University (UIN) Maulana Malik Ibrahim Malang and the State Islamic University (UIN) Sayyid Ali Rahmatullah Tulungagung. The reason for choosing these two locations is because firstly there is a uniqueness in the development of a smart campus to build an academic culture. Second, these institutions have their own characteristics and particularities, especially in developing smart campuses at their respective institutions.The data in this research was extracted through participant observation, in-depth interviews, and document study during field research, so that the phenomenon can be understood based on theory [14]. Primary data in this research consists of the behavior and words of informants related to the development of a smart campus in building a digital-based academic culture. Support is obtained through various documents in the form of photos, drawings, guidelines and objects that are relevant to the research theme so that they can be used to complement primary data.

Informants or data sources in this research are research subjects selected based on certain reasons in accordance with the theme, focus and objectives of the research, namely informants who really know and understand the information needed in the research. Key informants in this research include: chancellor, vice chancellor, dean, head of department/study program, community center manager, and students. Data analysis is carried out during the research process by condensing the data and verifying it from the research data that has been collected and then sorting it using componential analysis. [15]. First, single site analysis. The analysis in this research was carried out until data saturation. [16]. Condensation is carried out by identifying, classifying and codifying data. Next, checking and selecting the data needed for the research is carried out. Next, the data is classified by type according to the research theme and grouped based on information to provide answers to the research focus and questions. After the data is classified, it is coded according to the type of research data to facilitate data analysis and checking. Second, multi-site analysis. This cross-site data analysis aims to find similarities and differences between the two locations through comparison of the data found at each site, as well as a process of combining the sites. From the data found at each site, a concept for each site was then built, followed by the preparation of concepts for the two sites. Based on these steps, complete and comprehensive conceptual findings will be obtained regarding the development of smart campuses in building academic culture, including strategies for developing smart campuses and the impact of smart campus development on digital-based academic culture.

III. RESULT AND DISCUSSION

A. Smart Campus Development System Design in Building a Digital-Based Academic Culture.

Development system design is the process of determining how the system works in terms of architecture design, interface design, database and file specifications, and program design. The results will form the system specifications [17]. Telkom smart campus identifies the scope of its development system including infrastructure availability, basic campus services, applications and content, as well as business and customer management in the campus environment [18].The system design was developed to support a smart campus by combining various devices, both hardware and software, including the internet, data center and building management as infrastructure. First, the internet as a network of computers and devices connected to each other is used in the design of the smart campus development system. Internet is a basic requirement in using the smart campus application and can be activated at any time by activating it in the campus area, both UIN Tulungagung and UIN Malang.

Second, the data center as a user data center for storing, managing and processing digital-based academic data which acts as the brain of various smart campus services and applications. Third, building management is the hardware for smart campus development from the HR managerial side. Smart campus infrastructure includes hardware (computer systems and networks connected to the internet) and software (supporting capacity for open-source hardware needs). Developing infrastructure availability as a condition for campuses to be able to implement a smart campus system is with complete internet network facilities, wireless internet, digital libraries and online academic systems, so that access to implementation can cover the entire campus area and student mess with a stable and quality internet connection. [19]. Based on the hierarchy of needs, Abraham Maslow emphasized physical needs and comfort in achieving human potential. This can be applied to academic infrastructure, where physical and environmental comfort are important factors in facilitating learning [20]. Using the internet effectively and efficiently can increase one's knowledge [21]. Building infrastructure (through academic data centers) as a means or amplifier for online learning can build an effective academic culture [22]. Shen & Tian explained that one of the university academic cultures includes the academic climate perspective. A good academic climate can be built through human resource development management [23].

Basic Services Based on Artificial Intelligence (AI), Jasson with Token (JWT) or LemonLDAP.

The basic services developed by universities based on Artificial Intelligence (AI) are in the form of collecting, analyzing and periodically evaluating smart campus systems from various academic community sources via the page https://smartcampus.uinsatu.ac.id through third party management (contractors) and page https://siakad.uin-malang.ac.id.Apart from that, UIN Malang is also developing basic services based on Single Since Once (SSO) via Jasson with Token (JWT) or LemonLDAP which have previously been used and will be developed in the future via the page https://padu.uin-malang.ac.id. Resident campus centric concepts, smart systems and dashboard management are also used as the basis for basic services. Basic services are services that ICT users need, namely providing hardware, software and other supports to use these services [24]. Higher education online channels in the form of pages/websites have an impact on academic information, so that there is an increase in (academic) learning culture [25].

Applications and Content Developed Through the Needs, Desires and Experiences of Interplace Users.

UIN Tulungagung in application and content design is developed based on the needs and desires of interplace users (each user), while UIN Malang in the design of smart campus applications and content is based on user experience or user experience when accessing smart campus applications. The application is a special service for smart campus users. Content services are services of information, data, science and works of art [24]. According to Everett Rogers' theory of diffusion of innovation, it is related to new ideas and technologies that are based on cultural needs [26]. In developing a smart campus, it is related that digital technology will be accepted and improve academics by facilitating the needs of the academic environment. Quality in education must meet the needs, hopes and desires of all users (stakeholders) [27]. Application and

content development can have implications for building academic culture, if it is tailored to the needs, desires and expectations of users.

Business Managers and Users by the PTIPD Team and Contractors.

Management of the smart campus by UIN Tulungagung is carried out by two parties, namely internal (PTIPD) and external campus (contractors). PTIPD is tasked with being the main administrator of all academic culture integrated with the smart campus, while the vendor is tasked with managing the smart campus system with tokens amounting to 15 billion. Business management and smart campus users at UIN Maulana Malik Ibrahim Malang are carried out by the PTIPD internal team, both technical and administrative. A smart campus is said to be successful if the needs of users and customers can be met consistently and satisfactorily. Smart campus requires a business pattern that is appropriate to create sustainable services without burdening users [24]. Smart campus-based learning is a learning medium that utilizes computer technology and internet networks so that it is easy for all students and lecturers to use in carrying out teaching and learning activities. The smart campus model is designed and managed to have a high level of effectiveness and quality of learning communication, thereby enabling the teaching and learning process to be easier [28], so that an academic culture can be built. The Smartcampus Development Design at the two universities is depicted in the **chart. 1.**

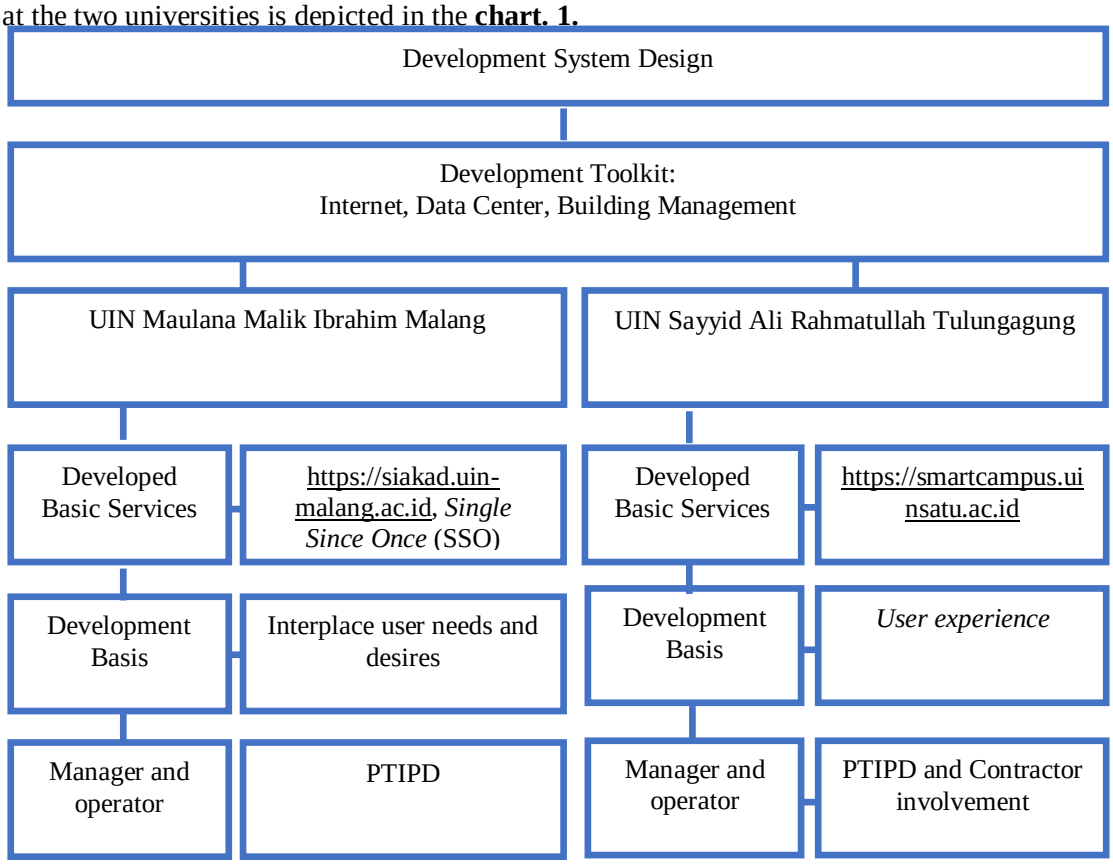


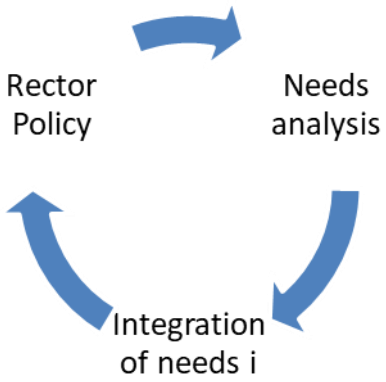
Fig 1. Smart Campus Development System Design

B. *Smart Campus* Smart Campus Road Map in Building a Digital-Based Academic Culture.

Smart campus road map is a road map as a reference in prioritizing the development of the smart campus system in the long term (the next five years). The reference for the arrangement is based on value or priority percentage [9]. Considerations for preparing a smart campus road map include portfolio, availability of human resources and budget support for smart campus development [29].

Portfolio in the Smart Campus Road Map

Smart campus road map at UIN SATU Tulungagung and UIN MALIKI Malang has a different path. The different road maps from the two universities can be an option in developing a smart campus. The options are depicted in **chart 2.**



UIN SATU TULUNGAGUNG UIN MALIKI MALANG

Fig 2. Road Map Smart Campus

The development of the Smart Campus at UIN SATU Tulungagung is based on a road map that is in accordance with the Chancellor's directions and policies without a blueprint for the direction of development. Apart from that, the smart campus road map develops based on needs without a clear master plan for the direction of needs. The UIN SATU Tulungagung smart campus road map was built with awareness of the need to use large data, making it easier to develop towards smart people. UIN MALIKI Malang has a road map through vision, mission and development handbook, but the specific implementation procedures are not yet clear. The UIN Maulana Malik Ibrahim smart campus road map is also adjusted to the chancellor's vision, so that the development vision is prioritized and clear. The smart campus road map of UIN Maulana Malik Ibrahim Malang was developed in accordance with the leader's (rector's) direction of thinking in a sustainable manner (Sustainable Leadership). The preparation of the master plan is based on the conditions and development needs of the university environment at certain time reference intervals. Planning a university master plan, especially in the field of information technology, is important and must be carried out to support the institution in terms of academic and institutional development [30].

However, both options each have advantages and disadvantages. The advantage of the road map carried out by UIN SATU Tulungagung is that smartcampus development can be done quickly, because the simple development steps allow for development efficiency. The drawback is that when a system has been developed, there is often a mismatch between the translation of requirements in the system and realistic, complex requirements in the field.Furthermore, the advantage of the road map carried out by UIN MALIKI Malang is that when the system has been successfully integrated, the chance of error is likely to be small because it has gone through extensive analysis and planning. The downside is that the development of a smart campus that uses road maps takes relatively longer because the flow used is more complex. Looking at the advantages and disadvantages of each road map indicates that changing traditional academic culture towards digital culture, whatever the conditions, is important to do, as per the change management theory coined by Kurt Lewin [31]. In the context of a smart campus, change management is the key to changing the academic culture towards a digital-based approach through a clear view of optimizing resources and portfolios.

C. Implementation of Smart Campus in Academic Activities in Building a Digital-Based Academic Culture.

Smart campus implementation is the process of implementing the design from the previous stages through a series of trials. Smart campus implementation is usually carried out by creating a database according to the design scheme, creating applications based on the system design, and testing and improving the application (debugging) [32]. Pratama, according to Irawan, et al.'s quote, explains that the implementation of a smart campus includes five areas, namely smart technology, smart governance, smart environment, academic environment, smart service, and smart policy (rules and policies) [33].

Multi Devices Gadgets, E-Mail, and Smart Boards as Smart Campus Technology.

UIN Sayyid Ali Rahmatullah Tulungagung uses a multi-device gadget with ownership of one e-mail address for each member of the academic community. Apart from that, there is a smart board available, namely TV Learning, to support hybrid class learning. The technology used at UIN Maulana Malik Ibrahim Malang uses a multi-device gadget with one e-mail address for each user. Smart campus with technology used to support academic community activities. One of the Tri Dharma domains of higher education is that service and efficiency through technology in a smart campus environment will increase educational efficiency [33].

Governance by the PTIPD Team and Contractors.

Smart campus management at UIN Sayyid Ali Rahmatullah Tulungagung is a collaboration between PTIPD as administration and a third party as manager. PTIPD is tasked with managing administrative aspects, while third parties (contractors) are charged with managing the smart campus system. Each admin of the faculty, study program or other members of the community as a structural member is given different access to help manage the management of each institution. The management carried out by the PTIPD UIN Maulana Malik Ibrahim Malang Team collaborates partially with the admins of related faculties or institutions to facilitate the process of managing and developing the smart campus system. Strengthening governance will lead to improving the performance of higher education institutions and the quality of products (graduates) [34], so that it is closely related to the academic culture that is being built. Through good technology management, it can open up opportunities to improve academic culture at Islamic Higher Educatioan (IHE) [35].

Academic Services Through Integrated and Separate Platforms.

The platform on the UIN Sayyid Ali Rahmatullah smart campus has been integrated into one portal house with twenty-four platforms in it to facilitate academic and administrative processes. It is known that there are twenty-five platforms that have been integrated into one including personal data, IRS, payments, leave applications, scholarships, academics, guidance applications, Smart Indonesian Card (SIC) selection, questionnaires, job information, Community Service Program apprenticeship, final assignments, graduations, learning digital, library, and student information. These platforms can be accessed via the page https://smartcampus.uinsatu.ac.id.UIN Maulana Malik Ibrahim smart campus platform has not been integrated into one portal house with thirty-five platforms through their respective pages (not yet integrated). The platforms used by the campus environment include SIAKAD, APP Journal institutional agenda, independent registration, postgraduate registration, Indonesian card registration, new student verification, student validation, APP lecturer, helpdesk, SIMAPEL, institutional website, PMB website, APP SISMABA, SIPERFORMA, SIPEMAS, UKT, APP SIMPEG, PTIPD bot, E-Learning, APP data, dentity manager, WFH attendance bot, APP SIMIRA, APP SIPABA, Vmeet UIN Malang, APP SIKERSA, APP, SIBAMIRA, VICON APP, APP siraja, UIN Student Bot, SIDIA APP, SIPERANG APP, Hosting Application, and PADU.Integrated service systems and systems can support the learning process using information technology. Smart campuses can integrate all components included in academic culture, especially in learning and educational models [36].

Rules and Policies are Based on the Chancellor's Vision, Mission and Regulations.

UIN Sayyid Ali Rahmatullah Tulungagung smart campus covers almost all academic fields to simplify the administration process and data base management by considering mitigation of use in the campus area as stated in the chancellor's regulations which must be carried out by lecturers, students and employees of UIN Sayyid Ali Rahmatullah Tulungagung. The UIN Maulana Malik Ibrahim smart campus is a formal application whose rules or policies are stated in the university's vision and mission, as well as the chancellor's regulations regarding the obligation to have a smart campus for lecturers, students or employees, and the implementation of blended learning teaching. Regulations are the basis for influencing institutional policy provisions [37], one of which is in building an academic culture.

Output of Smart Campus Development in Building a Digital-Based Academic Culture.

The output of smart campus development is the expected result of using a smart campus, which can be in the form of softcopy (people) and hardcopy (tools) [38]. Based on the Pura ICT program, ICT impact is

in the form of output and benefits from smart campus development related to leaders, lecturers, students and employees [39].

Development Output for Leaders.

Smart campus output for UIN leader Sayyid Ali Rahmatullah Tulungagung is a change from conventional direction towards modernity in the scope of digitalization. Smart campus refers to a change in mindset in understanding a smart campus with lecturers and students thinking smart. Changes lead to ways of behaving and perspectives in realizing digitalization in the campus area. The smart campus of UIN Maulana Malik Ibrahim Malang enables output that is felt by the leadership in the form of ease in providing smart campus-based academic services, both national and international students. One of the outputs of smart campus development for leaders is a decision support information system for higher education management [9], one of which is in building an academic culture for its users.

Development Output for Lecturers and Students

Smart campus output for lecturers and students at UIN Sayyid Ali Rahmatullah Tulungagung is a track record of data that has been backed up in a single smart campus application. Apart from that, the applications in the smart campus are academic support for its users. Smart campus also demands compliance in carrying out digital-based administrative processes and academic processes, both for lecturers and students [17]. The smart campus output for lecturers and students at UIN Maulana Malik Ibrahim Malang is accountability, transparency and certainty of the academic process. Accountability means that data is stored on the smart campus. Transparency means showing that the upload, storage or deletion of recorded data is clearly recorded. Academic certainty means that the teaching process does not require other tools to support it. An application program can produce appropriate output, if its functional requirements are met. However, if the output produced does not match the functional requirements, then there is an error in the program/application.

IV. CONCLUSION

Smart campus as a campus system that supports campus development through technology integration has an impact on the development of academic culture. The smart campus development system is designed with hardware and software facilities, as well as managerial design. The smart campus road map is used by considering administrative elements and resources, both human and financial. The implementation of smart campuses in academic activities is formed through adequate facilities and good managerial and regulatory aspects. The output of smart campus development has implications for the output and benefits of development for leaders, lecturers, and students. Be it, development system design, road map, implementation, and development output can build a digital-based academic culture.

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