

Towards Industry 4.0: Innovation of Digital-Based Academic Administration System in Islamic Religious Universities

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ARTICLE INFO

Keywords:

digital systems;
academic administration;
industrial revolution 4.0

Article history:

Received 2023-06-05

Revised 2023-07-23

Accepted 2024-02-07

ABSTRACT

The Industry 4.0 era demands digitalization in all fields, including public services in the higher education sector. This research aims to develop a digital-based academic administration service system. The research was conducted at the Faculty of Tarbiyah and Keguruan Sciences, Institut Agama Islam Negeri Palopo. The development method used was Rapid Application Development (RAD), with stages of requirements planning, system design, development and feedback collection, and product implementation. This research involved staff or education personnel and web developer experts. Data were collected through observation and validation questionnaires and analyzed descriptively using percentage techniques to determine validity. Product validity was tested by expert web developers through analysis using the Aiken V formula. This research provides an important understanding of the importance of digitalization in improving the efficiency and quality of academic administration services in the digital era. The results of this study provide a significant contribution to developing a digital-based academic administration service system and can be a foundation for further research and development in the future. This research significantly impacts academic administration practice by contributing to a digital-based service system. These findings can be the basis for further research and development on optimizing academic administration services in the digital era.

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1. INTRODUCTION

The Industrial Revolution 4.0 is an era of digitalizing public services that has become a fundamental need (Farida et al., 2020; Ellitan, 2020; Yang & Gu, 2021; Kagermann, 2015; Oliveira & de Souza, 2022). It is triggered by the increasing demands of people who want fast responses and services to their needs. This era is characterized by automation and digital technology-based services. Currently, digital technology is used to advance the education sector and to speed up and facilitate access to services (Townes et al., 2014; Ahmadi, 2017; Mallik & Mallik, 2017; Vicente et al., 2020). This implementation can help prevent illegal acts that can damage the reputation of services in the eyes of the public, such as illegal levies or bribes by irresponsible individuals.

The Industrial Revolution 4.0, the latest development in the industrialized world, demands adaptation and response from all sectors, including education. Slowly but surely, the education sector is developing and moving towards technological and social trends, namely digitalization. Technology and information updates are carried out along with implementing education implementer reforms. State Civil Apparatus (ASN) and education actors must adapt to technological changes to create more efficient and effective public services (Setyasih, 2019; Hartati & Iskandar, 2021). This adaptation will maximize their duties and functions and avoid negative images, such as the inefficiency of public services run by ASN. Therefore, a change in the mindset of service implementers is needed, where they must be directed to provide timely, easy, and affordable services by utilizing digital technology as an integral part of the Industrial Revolution 4.0 era.

In this era of digitalization, public services need to move quickly and efficiently, and academic administration services are no exception. In addition, the COVID-19 pandemic, which has forced all sectors to switch to online operations, also shows the urgency of improving digital services (Hermawan et al., 2022). Therefore, this research is very relevant and important. The study of digital public services in the era of the Industrial Revolution 4.0 has become an interesting topic for various researchers. Yunaningsih et al. (2021) explored efforts to improve service quality through digitalization, while Ilyas Bahagia (2021) examined the effect of public service digitalization on employee performance during the pandemic. Other researchers, such as Muharam (2019), offer innovations in public services in the context of the Industrial Revolution 4.0, while Polanunu & Rijal (2021) highlight the importance of digital-based public service innovation to realize good governance. Especially in the field of education, various focuses and approaches were born, but the research (Wardani & Kartika, 2020; Mesiono et al., 2021) emphasized the importance of digital-based public services in improving the quality of services to various stakeholders.

The Faculty of Tarbiyah and Teacher Science (FTIK) of the State Islamic Institute (IAIN) Palopo is one of the providers of public services in the education sector. As affirmed by Law No. 25/2009 on public services as an activity or series of activities in order to fulfil service needs under laws and regulations for every citizen and resident for goods, services, and/or administrative services provided by public service providers (Central Government of the Republic of Indonesia, n.d.). Public services are related to what the community feels and needs as service users (Abu-shanab et al., 2021; Foged, 2016). In this context, the service users are students.

Before the COVID-19 pandemic struck, IAIN Palopo had proactively implemented digitalization in the public service process by implementing an academic information system known as SIPAKATAU (Integrated Academic Service System). The Rector has drafted various regulations designed to maximize the implementation of digitalization in public services at the institution so that it can be an effective tool in realizing bureaucratic reform and innovation in public services, as well as a solution that can improve the quality of service to students. Since 2020, IAIN Palopo's Faculty of Tarbiyah and Teaching Sciences (FTIK) has developed a digital academic service known as SIKOLATA (Digital Academic Service Communication System), although this system does not yet include student academic correspondence creation services.

Implementing this digital-based academic administration service system is crucial, especially considering the data from the Higher Education Database (PD-Dikti) in November 2022, showing that the number of FTIK IAIN Palopo students reached 3,289 people. From initial observations, the services provided by FTIK IAIN Palopo are still mostly manual or face-to-face between students and service officers. This service method is less efficient and effective and has the potential to create crowds of students in the faculty corridor, resulting in a crowded, noisy, and less orderly environment and creating discomfort for both service users and service providers. In addition, students who cannot attend in person for various reasons cannot obtain optimal administrative services. Therefore, a new service is needed to overcome this problem.

This research departs from the argument that, as a public service provider, the state civil apparatus (ASN) at FTIK IAIN Palopo should ideally be able to provide the best administrative services that are

efficient, easy, and innovative. These innovations should be supported and based on the latest technological developments as they play a key role in the operationalization of digital public services (Burgos & Branch, 2021; Muharam, 2019; Polanunu & Rijal, 2021; Yunaningsih et al., 2021). In addition, using information and communication technology can simplify and streamline various academic correspondence services at IAIN Palopo's FTIK. Thus, it will align with the demands of the Industrial Revolution 4.0, which encourages the use of technology in all aspects of human life (Ilyas & Bahagia, 2021; Burgos & Branch, 2021).

This research aims to design and develop a digital-based academic administration service system that manages academic correspondence in the Faculty of Tarbiyah and Teacher Science services. This service includes handling various standard letters, such as active college certificates, scholarship certificates, graduation certificates, leave certificates, research permit application letters, and thesis submission certificates. This system is developed by emphasizing paperless technology and requires an internet connection. The results of this research are expected to provide innovative digital solutions to handle academic administration challenges in the Industry 4.0 era. The results of this study provide a better understanding of how the implementation of digital-based academic administration services can be applied, especially in the context of IAIN Palopo's Faculty of Tarbiyah and Teaching Sciences. This research will also provide recommendations for other institutions wishing to adopt a similar approach to improve their services.

Although the digitization of public services has been the concern of various researchers, there is still an unexplored gap, namely how the implementation of this digitization in the context of academic administration services, especially in the religious education environment such as in the Faculty of Tarbiyah and Teaching Sciences of IAIN Palopo. No research specifically reviews innovations in managing academic correspondence with a digital approach in religious education institutions. This study aims to fill the gap by examining and trying to provide digital-based solutions to managing academic correspondence at the Faculty of Tarbiyah and Teaching Sciences of IAIN Palopo.

This research brings its uniqueness by focusing on implementing digital-based academic administration service innovations at the Faculty of Tarbiyah and Teaching Sciences of IAIN Palopo, specifically in managing academic correspondence. Previous research has not examined how digital technology can be optimized in managing academic correspondence, so this research offers new perspectives and solutions in this context.

2. METHODS

2.1 Types of research

This research uses a type of development research: Research and Development (R&B). Development research (R&D) is a process for developing and validating educational products (Creswell & Creswell, 2003). The product developed is a digital-based academic correspondence service application. This research was conducted at the Faculty of Tarbiyah and Teacher Training, Institut Agama Islam Negeri Palopo, which will be held from December 2022 to February 2023.

2.2 Data source

This research took data from two main sources: educational staff in various study programs and faculties and expert web developers. Educational staff, with their background in administration and service, provided information through surveys and interviews regarding system needs. With their knowledge and skills in web development, expert web developers played a role in the system validation process. The data collected included survey responses, interview results, and feedback and judgments from the web developers.

2.3 Software development methods

The software development method used in the research is the Rapid Application Development (RAD) method (Martin, 1991). The research method used is Research and Development (R&D). The

R&D method was chosen because it aims to produce a valid and reliable educational product, a digital-based academic mail service application. In addition, this method also allows researchers to test the product's effectiveness in a real context, in this case, the Faculty of Tarbiyah and Keguruan at Institut Agama Islam Negeri Palopo. Research with this model has been conducted in several studies (Rad et al., 2021; Gumonan & Fabregas, 2021; Lohr et al., 2003; Chandra & Wahyuddin, 2022; Supianti P et al., 2022; Nilawati & Martin, 2023; Saksono et al., 2022; Azhari & Zulfikar, 2022).

The operationalization of this method is carried out through several stages, namely the needs planning stage, the system design stage, and the development and feedback collection stage. Data is collected through surveys and interviews to determine system requirements in the requirements planning stage. The system design stage involves an iterative refinement and design process until the system is designed according to user needs. The development and feedback collection stage involves creating beta and final versions of the system by considering user feedback and evaluations.

The Rapid Application Development (RAD) software development method was also used in this research. The reason for choosing this method is that the process is rapid and iterative, allowing users to provide feedback and ensure that the system is developed according to their needs. This RAD method is operationalized through the previously described planning, design, and development stages.

2.4 Data collection techniques

The data collection techniques in this study, namely observation and questionnaires, were selected based on their relevance to the nature and purpose of the study. Observation was used to understand first-hand how the application interacted with users, giving the researcher a real picture of the application's effectiveness. Meanwhile, questionnaires were administered to expert web developers to obtain professional and objective judgments on the quality and validity of the app. These two techniques comprehensively assisted the researcher in identifying areas of improvement and validating the app's usability in a real context.

2.5 Data analysis techniques

The data analysis technique in this study was conducted using a systematic and structured approach. Initially, a descriptive analysis was performed on the observed data. This analysis aims to provide a comprehensive and detailed account of the observed data, elucidating its characteristics and offering explanations in a narrative format. This step entails documenting the data gathered through firsthand observation of user engagement with the created website. The primary objective of this descriptive study is to offer a lucid and comprehensive depiction of the functioning of the Website and the manner in which users engage with it.

Furthermore, the data from expert validation was analyzed using the percentage technique. The scores obtained from each validator were converted into percentages using the formula: $\text{Score} = (\text{obtained}) / (\text{total score}) \times 100$. The data was then interpreted based on the predetermined criteria outlined in Table 1.

Table 1. Aiken Assessment Index V.

No	Percentage (%)	Criterion
1	$V \leq 0,4$	Less valid
2	$0,4 < V < 0,8$	Valid
3	$V > 0,8$	Very valid

The Aiken V technique, a well-known and recognized technique in this field, was used for further validation analysis. In this technique, the coefficients of the four aspects of validity are calculated based on the results of the instruments completed by the validators. After the calculation, the validity results are measured using the Aiken V Index scale, which ranges from 0 to 1. We refer to Table 2 to determine the assessment criteria based on the Aiken V Index value obtained.

Finally, after the data analysis process was completed, the researcher noted and considered all the suggestions and feedback provided by the validators. This information is very valuable to us, as it helps us in making improvements and enhancements to the products we have developed. By considering these suggestions and feedback, we ensure that our product is not only valid and effective but also responsive to users' needs and preferences.

3. FINDINGS AND DISCUSSION

This research was conducted to develop and validate a digital-based academic mail service application at the Faculty of Tarbiyah and Keguruan at Institut Islam Negeri Palopo. This study succeeded through systematic and structured research, designing a system that fits those needs, developing new features based on user feedback, and conducting product validation through expert web developers. The results generally show that the developed application has successfully fulfilled the objectives of this research, with expert validation showing that the product is of high quality and effective. In addition, this research also produced some important suggestions and feedback from the validators that will be used for future product improvements and enhancements. Thus, this research has made important contributions in developing and validating digital-based academic mail service applications and can be used as a reference for similar research in the future.

3.1 *Website design of academic administration service system*

The development of a digital-based academic administration service system website aims to facilitate managing, storing, and distributing mail electronically. This goal is realized in the form of a platform designed by considering various important aspects of website development, such as functionality, security, performance, scalability, user interface, integration with other systems, and level of acceptance by users.

In this design, there are several key components. Firstly, the Login interface is designed to ensure user security and accessibility. Next, the dashboard presents various important information briefly and clearly. Then, the letter submission feature allows users to submit letter requests online. This feature is designed to simplify the letter submission process and minimize possible errors. In addition, there is also a letter submission process feature that allows users to track the status of their letter submission. Finally, a sample letter has been completed as a reference for users in making letters.

Each component and feature in this website design has a specific and complementary function. The main goal is to create a digital-based academic administration service system that is efficient, effective, and easy for users to use.

3.1.1 Login

The Login feature on the digital-based academic administration service system website is the main entrance for users. In this context, users are students who enter a 'user name' and 'password' to access the service. The main idea of this feature is to use the Student Identification Number (NIM) as a 'user name', which is each student's unique identity in an educational institution. Furthermore, this feature also utilizes the current semester's BRIVA (BRI Virtual Account) number as the password. It aims to provide a higher level of security to the system and prevent unauthorized access. In conclusion, the login feature is designed to focus on user security and convenience, ensuring that only entitled users can access and use the services on the Website.

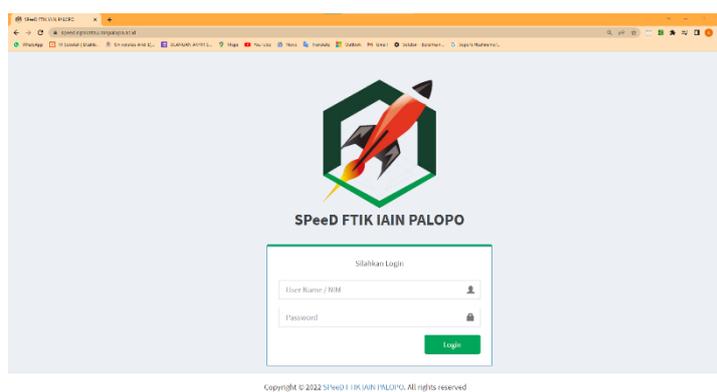


Figure 1. Login Feature

3.1.2 Dashboard

The name and logo buttons are used if the user wishes to view their profile. Furthermore, a 'Log out' button allows users to safely log out of the system once they use the service. The 'Dashboard' button is designed to allow users to view the status of letters that have been submitted. Additionally, the 'Riwayat Ajukan Surat' button allows users to view the history of the submitted letters. Other features are the '+Ajukan' and 'Detail' buttons, which select the type of letter the user requires. Finally, the 'Download Kebijakan' button provides facilities for users to download policies or rules relating to students. Thus, each button has a specific function designed to facilitate users' use of this website.

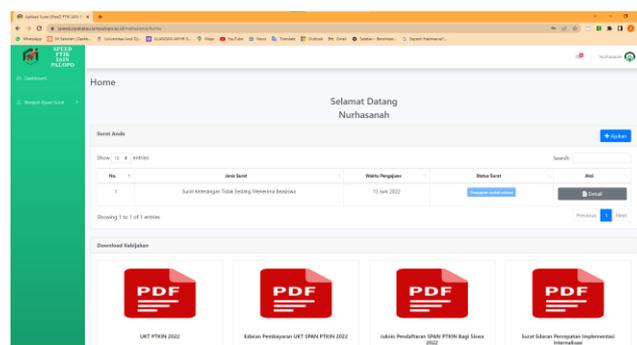


Figure 2. Dashboard

3.1.3 Apply for Letter

The main feature is the 'Jenis Surat' button, which allows users to select the type of letter they wish to submit. In addition, a 'Pilih..' button displays a list of available letters so that users can choose as needed. After selecting, clicking the 'Pilih' button can continue the submission process. Thus, this set of features forms an integrated and user-friendly system, making the letter submission process easier for users and increasing the effectiveness of academic administration services.

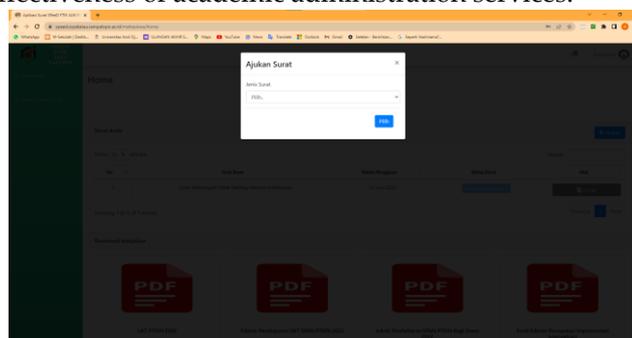


Figure 3. Letter Submission

3.1.4 Sample Submission Letter

The digital-based academic administration service system website allows users to submit various types of letters, such as Lecture Leave Letters, Research Permit Letters, Active Lecture Letters, Certificates of Not Receiving Scholarship, Graduation Certificate, and Certificate of Thesis Submission. In submission, users are asked to fill in their data in the fields provided. Then, there is a 'Pilih File' button to attach the required documents in PDF format. After all data and documents are ready, users can click the 'Ajukan' button to send the submission. Thus, this system facilitates mail submission with a simple appearance and intuitive functions.

Figure 4. Sample letter submission

After the process of submitting the letter and inputting the requirements is carried out, the user must wait for verification from the Admin. At this stage, the Admin will check the completeness of the files the user inputs. The letter's status will be displayed in the system, allowing users to always monitor the verification process. If the Admin has accepted the file, the letter will be forwarded to the Head of Section for review. The status "Menunggu Persetujuan Admin" will appear shortly after the temporary file has been checked. In addition, a 'Detail' button allows users to view the details of the submitted letter.

No.	Jenis Surat	Masa Perangin	Status Surat	Aksi
1	Surat Cuti	18 Jan 2022	Menunggu Persetujuan Admin	Detail
2	Surat Keterangan Tidak Belajar Menempus Boreas	17 Jan 2022	Menunggu Persetujuan Admin	Detail

Figure 5. Status "Menunggu Persetujuan Admin"

After obtaining approval from the Head of Section, the letter is forwarded to the Vice Dean for review. At this stage, the status of the letter changes to "Telah Disetujui oleh Kabag dan Diteruskan ke Wakil Dekan", which indicates that the letter has successfully passed the Head of Section's verification stage and is now under the review of the Vice Dean. To provide transparency, the system allows users to track the progress of the submitted letter through this status change. In addition, users are also given the convenience of viewing the details of the letter submitted through the button "Detail".

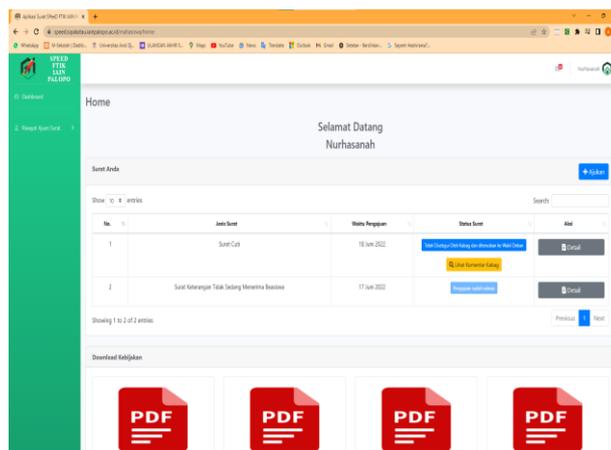


Figure 6. Display of Letter Approval Process by Head of section and Vice Dean)

After getting approval from the Dean, the letter will be returned to the Admin for the next process, namely letter numbering and adding other information if needed. At this stage, the letter's status is changed to "Telah Disetujui oleh Dekan, waiting for Admin to number the letters ". Features "Detail" is still available at this stage, allowing users to check the details of the submitted mail.

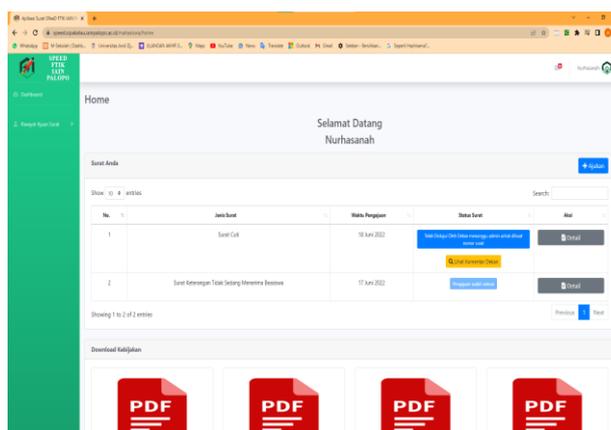


Figure 7. Letter Numbering Process by Admin After Dean Approval

After the Admin assigns the letter a number, the letter status will change to "Pengajuan Surat Selesai". Button "Detail" can view more details about the letter. Once clicked, a dialogue box will appear containing the letter details. You can use the "Lihat Surat" to download the letter file.

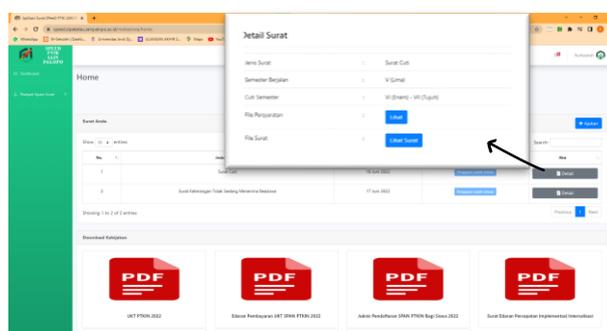


Figure 8. Final View of the Letter Submission Process with Status 'Pengajuan Surat Selesai' and Detail Surat.

3.1.5 Sample Letter

The Barcode Signature feature on approved letters is an important element in document verification. This feature serves as a document validity marker, which can be scanned with a smartphone to access the document's validity information. Implementing this feature brings efficiency to the verification process, minimizing the time and effort required in manual processes. In addition, this feature also enhances document security by limiting the potential for misuse.



Figure 9. Sample letter

3.2 Validity Test

Two web developer experts validated the validity test of the digital-based academic administration service system website design. Expert assessment is used as a reference for improving the website design developed. The validation assessment indicators include Website Design and Appearance, Website Content, Website Functions and Features, and Support and Assistance. Each indicator consists of several questions that represent the expert's assessment.

The first validator assessment is the Website's design and appearance, broken into five questions. The questions on the website design and appearance indicator are: 1) The website display is attractive and easy to understand, 2) Navigation on the Website is intuitive and easy to use, 3) The colours and fonts on the Website are easy to see and read, 4) The Website looks professional and reliable, and 5) The Website is designed responsively for various types of devices (computers, tablets, smartphones).

Figure 10 shows the results of the expert assessment of the design and appearance aspects of the Website. Understanding the information in this table is very important because design and appearance are the first aspects users will encounter when accessing the Website. Good design and appearance can provide a positive user experience and increase engagement. This figure includes several important elements such as visual interest, ease of understanding, intuitiveness of navigation, visual comfort from colours and fonts, and design responsiveness to different types of devices. This figure shows how the expert assesses each of these elements and how this Website fulfils expectations regarding design and appearance. In addition, the results of this assessment can also be valuable input for the future improvement and development of the Website. Therefore, it is important to understand and evaluate the information presented in this figure. The results of the expert assessment of the design and appearance of the Website are as follows:

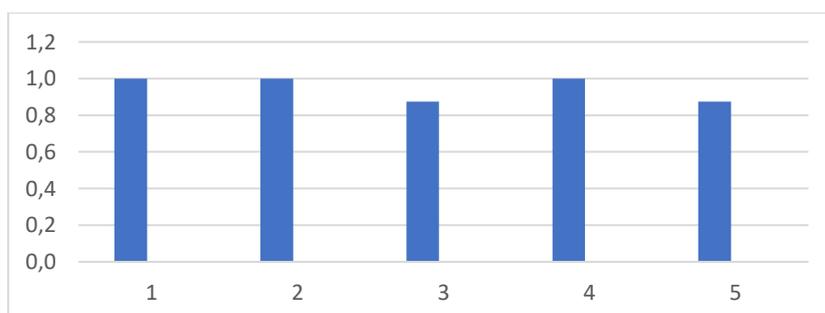


Figure 10. The results of expert assessment of website design and appearance

Based on the picture above, it can be explained that the criteria for all aspects related to the Website's design and appearance are very valid. It can be seen from the value obtained in the range of 0.9 and 1. The average expert assessment of the Website's design and appearance is 0.95. So, it can be interpreted that the value of the Validity Analysis Results of experts on the design and appearance aspects of the Website is in the very valid category.

The second validator assessment is Website Content, broken down into four questions. The questions on the Website Content indicator are: 1) The information displayed on the Website is up-to-date and accurate, 2) Website content is relevant to correspondence needs, 3) Important information is easy to find on the Website, and 4) The Website provides all the information needed for correspondence services.

Figure 11 displays the results of the expert assessment of the Website Content aspect. Website content is important because it is the core of user information. This figure includes expert assessments of the accuracy, relevance, ease of finding information, and availability of information needed for correspondence services. This information serves as a guide to improve and enhance the website content to better suit user needs and achieve higher satisfaction levels. The results of the expert assessment of the Website Content are as follows:

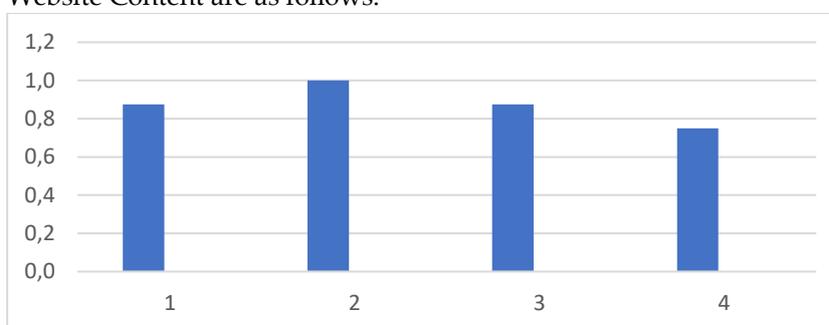


Figure 11. Results of Expert Assessment of Website Content

Based on the picture above, it can be explained that the criteria for all aspects related to Website Content are in the valid and very valid assessment. It can be seen from the value obtained in the range of 0.8 to 1. The average expert assessment of Website Content is 0.875. So, it can be interpreted that the value of the Validity Analysis Results of experts on the design and appearance aspects of the Website is in the very valid category.

The third assessment, the validator, is the Website Functions and Features, broken down into three questions. The questions on the Website Functions and Features indicator are: 1) The Website provides online service features that are easy to use, 2) All website functions can be accessed without technical problems, and 3) Website security features such as privacy and user data protection are good enough. Figure 3 displays the results of the expert assessment of the Website Functions and Features aspect. Website functions and features are crucial because they determine the ease and smoothness of users in using the online services provided. This figure includes expert assessments of the availability and usefulness of features, ease of access, and website security in maintaining user privacy and data protection. The information presented in this table provides insight into the strengths and weaknesses of the Website's functions and features that can be used to optimize website performance and improve user experience. The results of the expert assessment of Website Functions and Features are as follows:

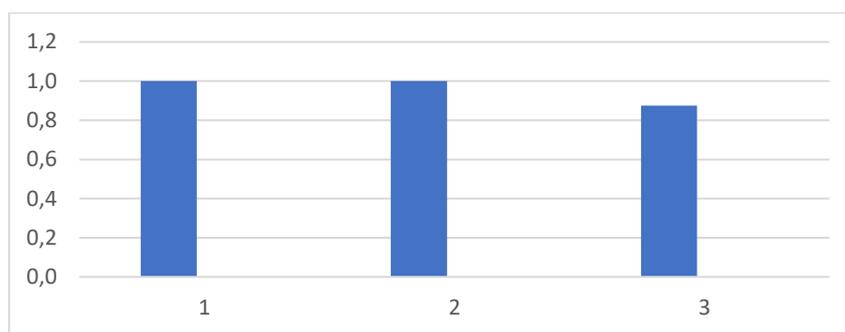


Figure 12. Results of Expert Assessment of Website Functions and Features

Based on Figure 12, it can be explained that the criteria for all aspects related to Website Functions and Features are very valid. It can be seen from the value obtained in the range of 0.9 to 1. The average expert assessment of Website Functions and Features is 0.96. So, it can be interpreted that the value of the Validity Analysis Results of experts on the aspects of Website Functions and Features is in the very valid category.

The fourth assessment, the validator, is Support and Assistance, broken down into three questions. The Support and Assistance indicator questions are: 1) The Website provides clear user assistance or guidance, 2) Questions or problems about this Website can be answered or resolved quickly, and 3) The Website provides clear contacts for technical support or other questions. Figure 4 illustrates the results of the expert assessment of the Support and Assistance aspect provided by the Website. This aspect is important because it determines how much the Website supports and guides users in dealing with service-related problems or questions. This figure includes expert assessments of the availability of user assistance or guidance, speed in responding to queries or problems, and the availability of clear contacts for technical support or other queries. Understanding the information presented in this table helps to improve and enhance the quality of the Website's support and assistance services to provide a better experience for users in using the services provided. The results of the expert assessment of Support and Assistance are as follows:

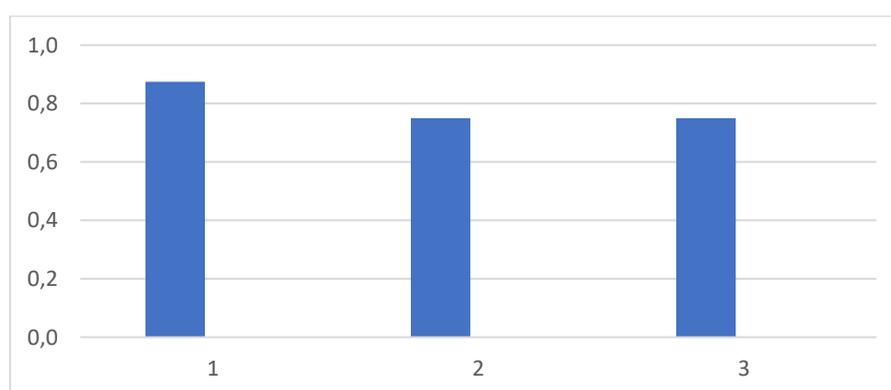


Figure 13. Results of Expert Assessment of Support and Assistance

Based on the picture above, it can be explained that all aspects related to Support and Help are under Valid and very valid assessment. It can be seen from the value obtained is in the range of 0.8 to 0.9. The average expert rating on Support and Assistance is 0.792. So, it can be interpreted that the value of the Expert Validity Analysis Results on the Support and Help aspect is in the valid category.

Discussion

This research aims to develop a digital-based academic administration service system website that can facilitate managing, storing, and distributing letters electronically. Website design involves several views such as Login, Dashboard, File a Letter, Sample Letter Submission, and Sample Letter Submission Process. The results of validity tests by two web developer experts show that the Website's design and appearance, website content, website functions and features, and the support and assistance provided have a good level of validity. Expert assessment of website design and appearance, website content, website functions and features, and support and assistance are in the very valid category.

The first validator assessment of the Website's design and appearance was 0.9 to 1, with an average assessment of 0.95. The assessment of the two validators on website content showed a value that was in the range of 0.8 to 1, with an average rating of 0.875. The third validator's assessment of the functions and features of the Website showed a value in the range of 0.9 to 1, with an average assessment of 0.96. The four validators' assessments of support and assistance showed scores in the range of 0.8 to 0.9, with an average rating of 0.792. These results show that the website design has a good level of validity in aspects of website design and appearance, website content, website functions and features, and the support and assistance provided.

In this study, a digital-based academic administration service system was developed to facilitate managing, storing, and distributing letters electronically. The validation results by two expert web developers show a good level of validity in various aspects, including design and appearance, content, functions and features, and support and assistance provided by the website. It shows that implementing digitalization in academic administration services following the research of Greekngsih et al. (2021) can potentially improve service quality.

Polanunu & Rijal Research (2021) and Burgos & Branch (2021) show the importance of digitalization in public services to realize good governance, which aligns with the main objectives of developing this system. The relevant literature study reinforces the findings of this study. For example, shows that digitalization can affect employee performance, which means this system can potentially help increase the productivity of administrative staff. Thus, this research contributes significantly to existing literature and digital-based public service practices.

Based on the results of research and literature studies that have been conducted, these findings indicate that digitalization in academic administration services is an important and effective step in the era of the Industrial Revolution 4.0. This study's service quality improvement through digital-based systems underscores the urgency and relevance of digitalization implementation in public services, especially education. In addition, the positive potential of digitalization on employee performance and the realization of good governance signifies that digital-based innovation can be the key to improving public service efficiency, effectiveness, and transparency. Therefore, the results of this study open up opportunities for further research and deeper development of digitalization in academic and public administration services in general.

The implications of the results of this study are quite significant. First, the good validity of the developed digital-based academic administration system shows that digitalization can be used as an effective tool to improve the efficiency and effectiveness of administrative processes, especially in education. It suggests educational institutions should look towards digitalization to address their administrative challenges. Second, these findings also have implications for public service practices in general. With improved service quality, positive potential for employee performance, and good governance, the digitalization of public services can be the key to providing better services to the community. Furthermore, this study provides valuable insights for other researchers interested in digitalization in public services and paves the way for further research.

The results of this study, which show the validity and effectiveness of a digital-based academic administration system, arise from several factors. First, the research was conducted with a mature and meticulous approach to system development, which included a well-thought-out design, relevant content, effective functions and features, and adequate support and assistance. Second, this research

was conducted in the context of the Industrial Revolution 4.0, where digitalization is key in improving the efficiency and effectiveness of various aspects of life, including public services and academic administration. Finally, the results of this study may also be reflected in the increasing needs and expectations of the public towards better and more efficient public services in today's digital era. Therefore, this research reflects the global trend towards digitalization and innovation in public services.

Based on the results of this study, several important actions need to be taken. First, educational institutions and other public entities must start or accelerate their digitization process if they have not already done so. Given the validity and effectiveness of the digital-based academic administration system developed in this study, implementing similar systems in other institutions can help improve the efficiency and quality of their services. Secondly, training and education should be provided to administrative staff and service users to ensure they can take full advantage of the benefits of this digital-based system. Lastly, more research should be done to continuously optimize and update these systems and expand our knowledge of digitalization in public services. The results of this study pave the way for further research and innovation in this field.

Although the results of this study indicate a good level of validity of the digital-based academic administration system, it must be recognized that implementing this system may face some challenges. One of the challenges that may be faced is the difficulty in adaptation and implementation in different educational environments with unique needs and structures. Therefore, educational institutions must thoroughly evaluate before implementing this system. In addition, adequate training for administrative staff and service users also needs to be a concern to utilize the benefits of this digital-based system fully. In addition, further research can be conducted to understand more deeply the long-term impact and effectiveness of this system in meeting the community's needs and expectations and continuously updating the system under technological developments and the growing demands of public services.

4. CONCLUSION

The findings of this study show that digitization not only improves the efficiency and effectiveness of administrative processes but also has the potential to positively impact employee performance. Assessments from expert web developers showed excellent validity of the developed system, especially regarding website functions and features. The pedagogical implications of these findings are important to study in the context of higher education. Educational institutions can utilize the concepts and models generated to introduce digital technology in academic administration processes, improve efficiency, accessibility and transparency of services, and develop learning programs that include digital literacy and information technology for students. Implementing digital technology in academic administration services can be an integral part of efforts to improve the quality of public services in the education sector and help students and administrative staff face challenges in the era of the Industrial Revolution 4.0.

This research presents the concept of developing a digital-based academic administration service system that is relevant and responsive to the needs of the Industrial Revolution 4.0 era. This concept provides a theoretical and practical foundation for optimizing academic and administrative services through digital technology. The added value of this research lies in the concepts developed. Although the research methods are important to ensure the validity and reliability of findings, the resulting concepts have much broader potential to inspire better future research and public service practice. In this regard, this research makes an important contribution in directing attention to the importance of digitalization in improving the quality of public services. Although this research contributes significantly to developing digital-based academic administration service systems, some limitations must be noted. First, the study focused on one educational institution and may not represent the same situation at another. Therefore, follow-up research may involve a wider sample of educational institutions to test the generality of these findings. In addition, the study did not involve service users

directly in gathering their feedback. Therefore, further research can involve potential users of these systems to evaluate their satisfaction with the features and functionality provided. Furthermore, future research may also explore the long-term impact of digitalization on academic and administrative services, including analysis of efficiencies and changes in the working patterns of administrative staff.

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