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PAPER

An Information Service Platform for Decision Support in Academic Admissions Using Data Fabrics and Artificial Intelligence

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ABSTRACT

This paper presents the architecture of an information service platform for decision support in academic admissions, utilizing data fabrics and artificial intelligence. The factors affecting students' further education can be classified into four main types: (1) the course, (2) image, (3) personal reasoning of the student, and (4) public relations. The process of providing information for decision support in academic admissions can be divided into six stages: (1) collecting information, (2) matching study guidance, (3) recommending appropriate education, (4) confirming information, (5) assessing student admissions, and (6) providing feedback. Data fabric is an increasingly popular technology application for data management. The data fabric architecture consists of six layers: (1) an augmented data catalog, (2) a knowledge graph enriched with semantics, (3) metadata activation, (4) a recommendation engine for active metadata, (5) data preparation and integration, and (6) orchestration and data operations. A smart decision support system (DSS) technology is used to assist in decision-making. The results showed that this architecture has an excellent level of suitability (mean = 4.56, standard deviation = 0.35). It can be applied to a university to help it become a digital university and align with its mission.

KEYWORDS

information service platform, decision support system (DSS), academic admission, data fabrics, artificial intelligence (AI)

1 INTRODUCTION

Nowadays, technology and information have influenced the needs of individuals and society. The changes in the labor market have been significant. Therefore, higher education is more competitive. This phenomenon has caused a paradigm shift in the higher education system. Education is one of the most critical challenges in the

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world, and the strength of a nation depends on the quality of its education. Therefore, one must be prepared to face the constant development of technology and information, particularly the use of information to support decision-making in university admissions. Many universities have vast volumes of complex, scattered internal and external data. On the other hand, access to information is limited because modern applications are unable to access legacy storage. Because the system is structured as separate data silos, where each organization stores its data independently, it leads to data stagnation. Over time, the data becomes inaccessible [2]. This results in a lack of reliability for data storage and security. The solution is not to improve silo storage or modernize silo data. Alternatively, they may not be using advanced applications, but they must still be able to solve the problem of handling large amounts of data. The answer to these problems involves implementing data fabric as the most suitable method [3]. This will increase the efficiency of accessing distributed data. It also helps to organize data intelligently and supports digital storage. Moreover, access to information is easier and helps support user decision-making [4], [5]. A decision support system (DSS). DSS is a computer-based system designed to enhance and facilitate decision-making by addressing semi-structured and unstructured problems. DSS is a computer-based interactive system that assists decision-makers in utilizing data and models to solve unstructured problems. At this stage, the writer will conduct a system analysis with four phases contained in the SPK, namely: 1) intelligence phase, 2) design phase, 3) selection phase, and 4) action implementation phase. [13]. The first step at the stage of admission to a university is to determine the professional inclinations of the applicant, his career interests and aspirations, and, as a result, the choice of an educational program. Along with this, situations often arise when an applicant doubts the correct choice of a training program due to various factors, one of which is insufficient awareness of their personal characteristics and/or a lack of understanding of how those qualities correlate with the chosen specialty. Choosing the wrong field of study can lead to dissatisfaction with one's profession. According to the super job study, 72% of Russians are dissatisfied with their current field of study. One of the main reasons for this issue is making the wrong choice when selecting a university major. [20].

Considering the aforementioned importance, the main objectives of this study are as follows: (1) to analyze the factors that influence students' decision to study; (2) to develop an information service process for decision support in academic admissions using data fabrics and artificial intelligence (AI); (3) to design an information service platform architecture for decision support in academic admissions using data fabrics and artificial intelligence; and (4) to evaluate its effectiveness.

2 LITERATURE REVIEW

The university has several information service platforms, including the graduate employment information service. This platform connects information on various topics, such as social, economic, and personal connections, and gathers job recommendations to enhance the quality of employment to a higher standard [69]. There are also library, intelligent campus, and central educational administration information service platforms [10–12].

Decision support systems consist of a human-computer interaction as the interface between the decision support system and the user, involving interactive steps in accordance with the system development methodology [13], [14]. It is a computer system that enhances and supports the effectiveness of decision-making in

unstructured and semi-structured situations [15], [16]. A decision-maker can utilize data and models to solve unstructured problems using this interactive computer system [15]. Four steps have been identified in the decision support system model. These steps consist of: (1) the intelligence process, which involves indication, meaning, and problem understanding; (2) the design process, which analyzes possible actionable approaches for the problem; (3) optional steps involving problem-solving patterns, validation, and testing; and (4) carrying out the chosen alternative through implementation steps and reviewing the solution [17], [18]. The user is indecisive about many research activities used in education. DSSs are considered to be more useful tools as they can select a student's course of study based on personal traits and skill interests, connect completed courses to major and minor requirements, and more [19–21].

The admission of students to continue their studies is significant at any university. Many factors were found to have an impact on the decision to continue studying. A questionnaire was used to determine the factors influencing students' continued education. The main factor, as it was discovered, was the location of the educational institution. Others include, the quality of the courses, cost, reputation of referrals, motivation, and personal preferences [22]. Through in-depth interviews with students, we uncovered the factors that influence their educational decisions. These factors include the university's reputation, employment opportunities after graduation, costs, safety, and available resources for education and travel. While in college, there are various events, places, friendship groups, and mentors [23]. The factors necessary to make informed decisions about further education include location, reputation, employment opportunities, and prospects for graduates [24]. The website's publicity, an essential aspect of promotion, showcases the university's reputation [25]. Students are primarily interested in the infrastructure, reputation, teaching and learning methods, and other aspects of the university's location [26]. Most parents choose top-notch educational institutions to provide their children with better job opportunities. Therefore, their perspective on further education is influenced by the recommendations of these institutions [27]. Factors can also be related to course quality and aspects recommended by seniors [28]. The reputation of the university is one of the factors that influence people's decisions to attend [29]. Factors influencing further education include academic quality, tuition fees, scholarships, location, and facilities. The quality of the instructor and one's career prospects after graduation are also significant factors in promotion [30]. The factors of public relations marketing and the employment opportunities available upon graduation are essential [31].

Data fabric is a dynamic, distributed corporate data architecture. It helps organize information and makes it easy to use when the information is distributed among organizations, providing flexible search methods and adapting data to their format [32–34]. This includes users, data sources, multi-cloud services, and hybrid clouds. During pre-processing, it improves data integrity and provides high-quality data. Cross-cloud interactive scenarios are supported as part of this, which helps to enhance value while streamlining data management and facilitating decision redesign [35–41]. A reference architecture is developed for data ecosystems in complex scenarios for data management and the use of knowledge graphs for data integration [42]. This is a service-oriented system with interfaces and mechanisms that provide data access and storage capabilities [43]. A "schematic-centric data structure" is integrated into the platform to drive the user experience in the selection, consolidation, preparation, and sending of data to third-party analysis tools [44], [45]. The process of creating a data production system involves connecting to all necessary data sources and computing services, such as software as a service (SaaS), databases,

file transfer protocol (FTP) for file sharing, web services, and migrating the required data. Post-processing to a centralized location is completed by utilizing all components of the data fabric. In addition, the data from the offers is mixed and encrypted during confidential processing to generate reliable analysis results and assist organizations in making informed decisions [38], [41], [46], [47]. A complementary approach is to develop data fabric solutions for interoperability specific to different domains. Collaborators use teams to share data through standard repositories or make their datasets available through interoperable solutions and application programming interfaces (APIs). By utilizing the data fabric within the framework, data can be consumed and reports can be generated [48–50].

Artificial intelligence involves perception, analysis, and objective judgment similar to that of the human brain [51]. Most of these are artificial representations that simulate a complex set of human intelligence activities, such as perception, learning, reasoning, and communication, which differ from natural human intelligence. It is similar to the way humans perceive machines [52]. The framework for the artificial intelligence process generally has two steps: (1) apply a machine-learning (ML) AI model with training techniques to the dataset, and (2) implement a specific data inference model [53]. AI in education supports learners to have a more satisfying and engaging learning experience. The process of developing the platform follows these principles: (1) studying existing solutions, (2) reviewing the content, (3) discussing the requirements, (4) testing, (5) presenting and receiving feedback, and (6) regularly updating information [54]. AI engineering is a novel concept of teaching and learning in universities [55], [56]. Most educational service platforms rely on cloud computing and fall into three categories: service hierarchy, database structure, and internal management structure [57].

3 METHODOLOGY

3.1 Synthesis of documents and related research

We began by developing a set of user stories that describe the required functionality and features of the software.

This synthesizes relevant information and conducts research to design the architecture and the information service platform for decision support in admissions. This was achieved by utilizing data fabrics and AI, as illustrated in Tables 1–4.

Table 1. Concept and process of decision support system

Concept and Process	[13]	[14]	[15]	[16]	[17]	[18]	Synthesis
1. Intelligence	✓	✓	✓	✓	✓	✓	✓
2. Design	✓	✓	✓	✓	✓	✓	✓
3. Selection process	✓	✓	✓	✓	✓	✓	✓
4. Implementation	✓	✓	✓	✓	✓	✓	✓

Based on Table 1, the concept is as follows: A DSS is a computer system designed to enhance and facilitate decision-making performance in semi-structured and unstructured situations. It can also interact with computers, enabling decision-makers to utilize data and models to solve unstructured problems. There is a four-step process: (1) intelligence, (2) design, (3) selection, and (4) implementation.

Table 2. Factors in the decision support system

Factors	[22]	[23]	[24]	[25]	[26]	[27]	[28]	[29]	[30]	[31]	Synthesis
1. Course	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. Image	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. Persona reasoning	✓	✓			✓		✓		✓	✓	✓
4. Public relations			✓	✓		✓		✓	✓	✓	✓

According to Table 2, the analysis of factors influencing students' decisions to study further reveals four main factors and thirteen minor factors. These factors are as follows: (1) the course factor, which consists of six sub-factors; (2) the image factor, with three sub-factors; (3) the student's personal reasoning, including two sub-factors; and (4) the public relations factor, involving two sub-factors.

Table 3. Concept and component of data fabric

Concept and Component	[35]	[38]	[41]	[47]	[58]	[59]	Synthesis
1. Derived storage layer	✓	✓	✓	✓	✓	✓	✓
2. Data management layer	✓	✓	✓	✓	✓	✓	✓
3. Knowledge graph layer	✓	✓	✓	✓	✓	✓	✓
4. Data directory layer	✓	✓	✓	✓	✓	✓	✓
5. Application model layer	✓	✓	✓	✓	✓	✓	✓
6. Data access layer	✓	✓	✓	✓	✓	✓	✓

Based on Table 3, the concept is as follows: The data fabric technology model is distributed based on metadata in a knowledge graph. Virtual data relationships are established through knowledge graphs to integrate data across businesses and systems. This allows users to request, search for, match, and recommend relevant data using a variety of data analytics algorithms. For personal use, the data is encrypted, and the layer of secrecy ensures that the data is trustworthy when making decisions. It consists of six layers, as shown in the table.

Table 4. Concept and component of artificial intelligence

Concept and Component	[53]	[58]	[59]	[60]	[61]	[61]	[62]	Synthesis
Process framework:								
1. Machine learning	✓	✓	✓	✓	✓	✓	✓	✓
2. Conclude specific data	✓	✓	✓	✓	✓	✓	✓	✓
Principles of platform:								
1. Study the guidelines	✓	✓	✓	✓	✓	✓	✓	✓
2. Content of the application	✓	✓	✓	✓	✓	✓	✓	✓
3. Discuss requirements	✓	✓	✓	✓	✓	✓	✓	✓
4. Test the application for bugs	✓	✓	✓	✓	✓	✓	✓	✓
5. Application and get feedback	✓	✓	✓	✓	✓	✓	✓	✓
6. Update Application	✓	✓	✓	✓	✓	✓	✓	✓

In Table 4, the results for the concept and component of AI show that the AI process framework has two steps: model development and inference. To create the best AI model, it is necessary to develop a data-intensive model algorithm to learn its computational capabilities. The process of AI is as follows: (1) utilizing AI models in ML with training techniques for datasets, and (2) at this stage, model development is essential to generate specific data. The principle of platform development has six steps, as shown in the table.

The synthesis and related research are shown in Figure 1. It presents a bibliographic analysis of the information service platform for decision support in academic admissions. The platform utilizes data fabrics and AI, which include the DSS, data fabric, and AI components. The main component is the data fabrics and AI group, which is further divided into subgroups that are interconnected.

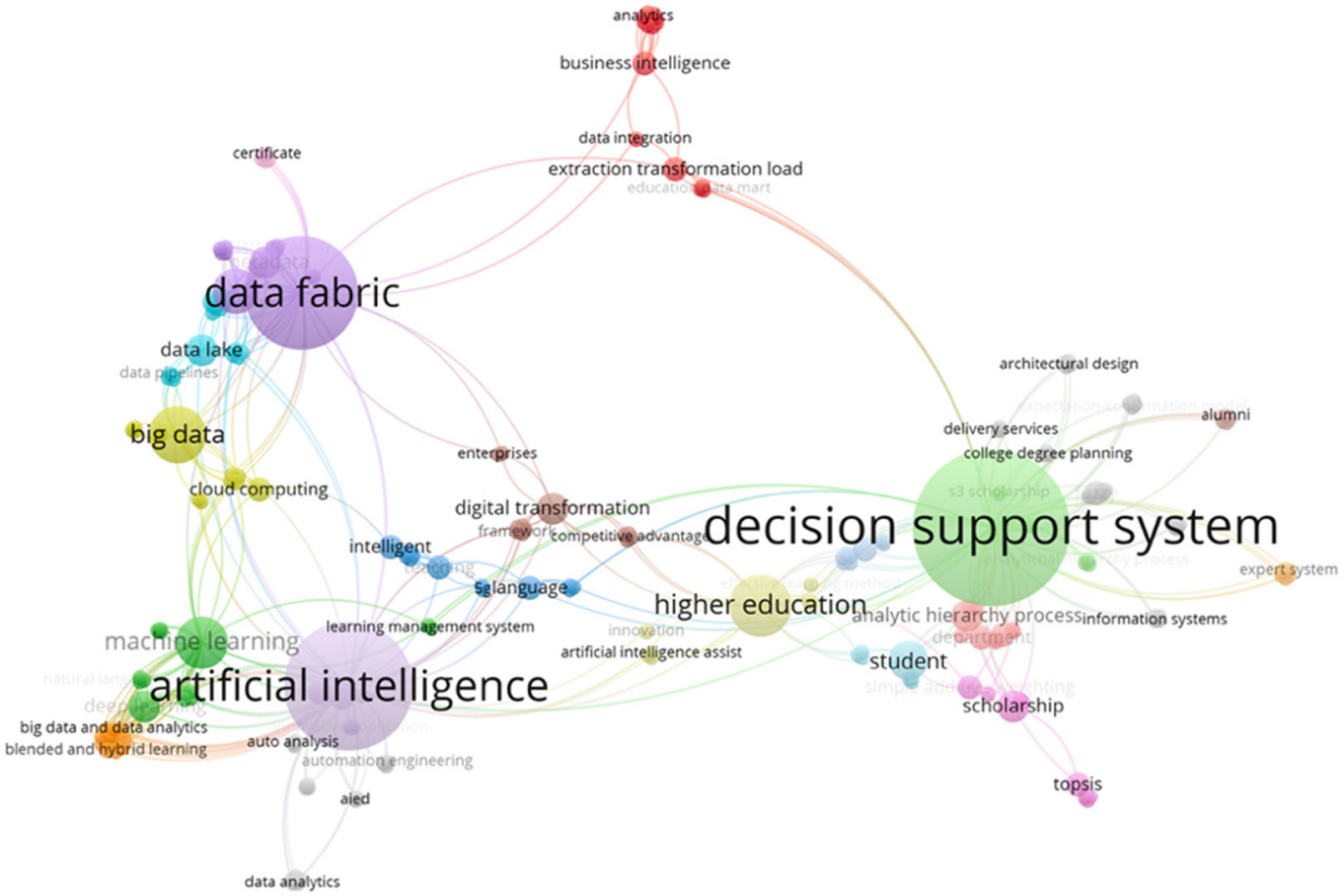

Fig. 1. A bibliographic analysis of the information service platform for decision support in academic admissions using data fabrics and artificial intelligence

3.2 Framework and information service platform

The framework of the information service platform for decision support in academic admissions, which utilizes data fabrics and AI, is depicted in Figure 2.

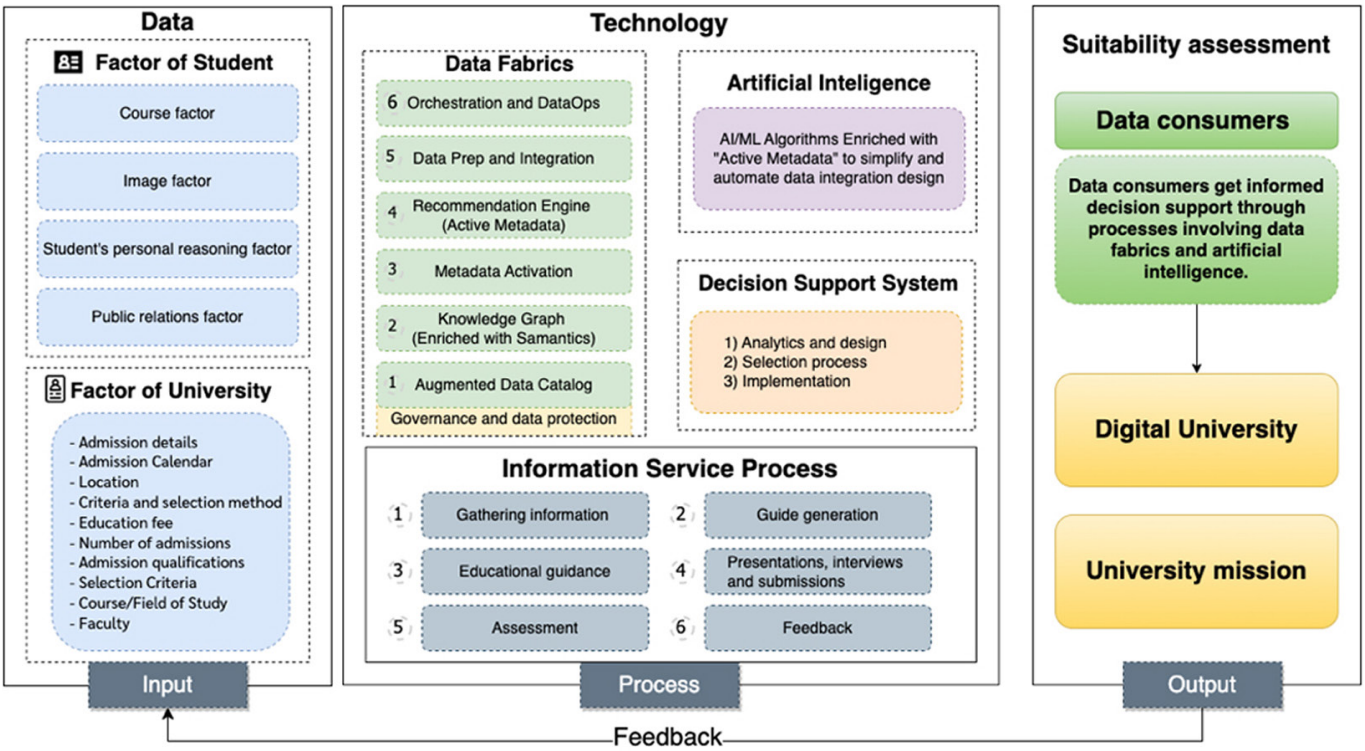

Fig. 2. A framework for an information service platform for decision support in academic admissions using data fabrics and artificial intelligence

Figure 2 shows that the framework consists of data imports. For students interested in further study, there are four main factors: the course, reputation, personal motivation, and public perception. In terms of university data that must be imported, there are 10 main factors, namely: admission details, admission calendar, location, criteria and selection method, education fees, number of admissions, admission qualifications, selection criteria, course or field of study, and faculty.

This research will utilize a DSS that comprises three components: (1) analytics and design, (2) a selection process, and (3) implementation. This study will apply data fabrics and artificial intelligence design concepts to effectively manage data. There are six main steps in the service process, as follows: (1) gathering information, (2) generating a guide, (3) providing educational guidance, (4) conducting presentations, interviews, and submissions, (5) assessing, and (6) providing feedback. Every step of the work process will yield data for consumers. Ultimately, this will yield data for the transformation into a digital university, aligning with the university's mission.

An analysis was conducted in this study. The researcher has designed a method for analyzing the DSS. First, clearly define the purpose of the DSS. Specify how you want the system to assist in making academic admissions decisions. Or give advice on choosing the right course for each student, etc. Next, design and develop systems to support use on various devices. And in different conditions, it is important to prioritize data auditing and data security. Then, utilize suitable technology to support the system. This can include a DSS, a data fabric, and AI to aid in decision-making and data analysis. Take into account factors that affect the decision-making process, such as the factors influencing students' decisions to pursue further study and the factors related to the service process. Afterward, develop and test the system to verify the accuracy and capability of the DSS in accepting the desired academic program. This includes checking the efficiency and suitability of the technology applied to the designed structure.

4 RESULT

The framework of an information service platform for decision support in academic admissions, utilizing data fabrics and artificial intelligence, is depicted in Figure 3.

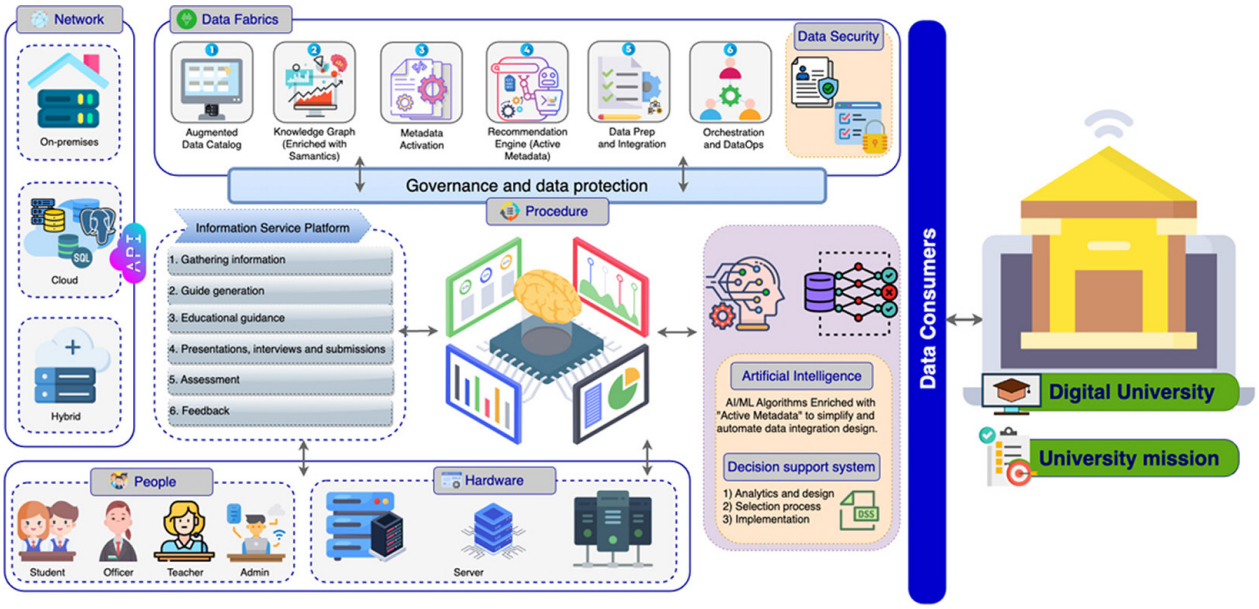

Fig. 3. The architecture of information service platform for decision support in academic admissions using data fabrics and artificial intelligence

In Figure 3, it can be seen that the architecture consists of six main modules.

1. The users consist of four main groups: (1) students who are secondary level learners, where vocational certificates and vocational certificates in applications serve as input factors that affect further study, (2) officers who are responsible for the admissions of each faculty in the university, (3) teachers who are responsible for the curriculum for admissions to each faculty in the university, and (4) administrators who check the system and solve system problems.
2. The architecture consists of six components, two of which are described separately: people and software. Several technologies are used for development, as described above. The four components in this section are hardware, procedures, databases, and networks.
3. The developed application can be supported on a variety of devices and can function in different conditions, ensuring monitoring and data security.
4. The factors that affect the work process consist of two main aspects, as follows: (1) factors affecting students' further education and (2) factors in the information service process.
5. The architecture utilizes three main technologies: the decision support system, data fabric, and artificial intelligence.
6. Ultimately, the goal of this architecture is to transform a university into a digital university that aligns with its mission.

From the above, the researchers designed the architecture of the application system to assist in the decision-making process for interested applicants and is able to determine the potential direction for studying and supporting a career based on specialization as follows:

The university has established an information service process to support applicants in making admission decisions, gathering information about their interests, matching them with study guides, recommending suitable studies, confirming information, assessing student admissions, and providing suggestions. Situations often arise when applicants doubt the authenticity of the developed applications that support various conditions, data auditing, and personal data security awareness.

A DSS is an information system that primarily focuses on managing data and information for utilization. It is composed of a collection of components. Additionally, it provides a range of decision-making options for various challenges. It can also be characterized as a computational system that facilitates decision-making processes by utilizing data and models to address unstructured challenges [66]. This system has been specifically developed for the purpose of informing academic admissions decisions. This tool has the ability to assist individuals aspiring to navigate their educational and professional trajectories effectively. It provides tailored guidance and support that is specific to their chosen area of concentration. It has procedures that cover both information assurance and information security. This can prioritize making informed decisions and increase the ability to assess the impact on those who choose to use this system. Ultimately, this design aims to facilitate the transformation and evolution of the institution that is into digital university in line with its mission.

5 DISCUSSION

The results of the architecture assessment by nine experts are presented in Table 5.

Table 5. Results of the architecture assessment

Assessment List	Mean	S.D.	Opinions
1. Input			
1.1 Students interested in further study	4.78	0.67	Excellent
1.2 Instructors in charge of the course	4.56	0.73	Excellent
1.3 Student admissions officers	4.67	0.71	Excellent
1.4 Administration staff	4.56	0.73	Excellent
Total	**4.64**	**0.67**	Excellent
2. Component			
Hardware, Procedure, Database, Network	4.89	0.33	Excellent
Total	**4.89**	**0.33**	Excellent
3. Application	4.56	0.53	Excellent
Total	**4.56**	**0.53**	Excellent
4. Process			
4.1 Factors affecting further education			
– Curriculum factors	4.89	0.33	Excellent
– Image factors	4.67	0.50	Excellent
– Personal reasons factors	4.67	0.50	Excellent
– Public relations factors	4.56	0.53	Excellent
Total	**4.69**	**0.41**	Excellent

(Continued)

Table 5. Results of the architecture assessment *(Continued)*

Assessment List	Mean	S.D.	Opinions
4.2 Factors in the information service process			
– Gathering information	4.78	0.44	Excellent
– Pairing study guides	4.78	0.44	Excellent
– Educational guidance	4.89	0.33	Excellent
– Presentations, interviews and submit	4.89	0.33	Excellent
– Assessment of student admissions	4.89	0.33	Excellent
– Feedback	4.89	0.33	Excellent
Total	**4.85**	**0.33**	Excellent
5. Technology			
5.1 Decision Support System	4.67	0.71	Excellent
5.2 Data Fabric	4.78	0.44	Excellent
5.3 Artificial Intelligence	4.78	0.44	Excellent
Total	**4.74**	**0.52**	Excellent
6. Summary of Benefits			
6.1 Digital University	4.67	0.50	Excellent
6.2 In line with the university's mission	4.78	0.44	Excellent
Total	**4.72**	**0.44**	Excellent
Total	**4.56**	**0.35**	Excellent

As listed in Table 5, the assessment results of the information service platform for decision support in academic admissions, which utilizes data fabrics and AI, are excellent overall (mean = 4.56, standard deviation = 0.35). The platform consists of six modules. When considering each module, it was found that for Module 1 (input), the overall picture is at an excellent level (mean = 4.64, S.D. = 0.67). The following outcomes were achieved for the system users, specifically students interested in further study (mean = 4.78, S.D. = 0.67), student admissions officers (mean = 4.67, S.D. = 0.71), instructors in charge of the course (mean = 4.56, S.D. = 0.73) and administrative staff (mean = 4.56, S.D. = 0.73). Module 2 for the component is excellent overall (mean = 4.89, S.D. = 0.33), including the hardware, procedure, database, and network. For Module 3, the application part, the overall picture is at an excellent level (mean = 4.56, S.D. = 0.53). Module 4, the process part, consists of factors affecting further education of students. The overall level is excellent (mean = 4.69, S.D. = 0.41). The overall level for factors in the information service process is excellent (mean = 4.85, S.D. = 0.33). Module 5, the technology section, is at an excellent level overall (mean = 4.74, S.D. = 0.52) and is made up of data fabric and AI components of the system are highly advanced, with an overall rating of excellence (mean = 4.78, S.D. = 0.44) for both the technologies and the DSS (mean = 4.67, S.D. = 0.71). Module 6, the summary of benefits section, is generally at a good level (mean = 4.72, S.D. = 0.44) and which aligns with the university's mission of raising the standard of education to an international level (mean = 4.78, S.D. = 0.44), as a digital and high-performance university (mean = 4.67, S.D. = 0.50) successive.

6 CONCLUSION

This paper describes the architecture of an information service platform for decision support in academic admissions, utilizing data fabrics and AI. Educational institutions or organizations that wish to implement this architecture should be prepared in the following six areas: (1) personnel, (2) software, (3) hardware, (4) database, (5) network, and (6) procedures.

As a result of this research, when educational institutions or organizations implement the architecture designed for the development of their systems, it will enable a university to become a digital university in accordance with its vision. This is in line with the objectives of "developing digital technology systems to enhance teaching, learning management, and student services" and "developing a digital technology system to elevate the quality of teaching, learning management, and student services to the level of a digital university." This is consistent with the university's strategy of enhancing management efficiency through the use of technology. The architecture was evaluated by nine experts as excellent overall (mean = 4.56, S.D. = 0.35).

The results show that the platform's modules have received excellent ratings overall, and users are highly satisfied with the system. Additionally, the technology used, particularly data fabric and AI, has been found to be excellent. The field of ML has originated in the domain of AI, with the objective of using computational systems to replicate human cognitive abilities. Hence, the utilization of ML models in conjunction with intelligent software significantly enhances the effectiveness and reliability of intelligent decision-making processes [67]. The platform is also aligned with the university's mission to become a digital and high-performance university. Overall, the result supports the effectiveness and suitability of the designed architecture for decision support in academic admissions. The use of data fabric technology in the system makes the DSS efficient in managing and organizing data effectively. This allows users to access and process information quickly and with flexibility. Make the system respond to the needs of academic admissions efficiently. This makes data fabrics' rating highly satisfactory, including the successful performance of the DSS in supporting academic admissions decisions appropriately. The development of several methodologies by DSS has facilitated managerial support in strategic domains [68]. Including supporting the university to change and develop into a digital university in accordance with the mission. It is an important goal to develop a system that pushes the boundaries of continuous development, aiming to transform the university into an innovative institution that can be digitally serviced and controlled. This transformation should align with the provision of new services, enabling success in adapting to current social changes.

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