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Artificial intelligence-powered decision support system for operational decision-making in the ICT department of a selected African university

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This paper aims to explore the effect of an artificial intelligence-enabled decision support system (AIDSS) on decision-making processes within a university setting, focusing on the ICT department of a selected South African university. The research objectives revolve around the effectiveness of AIDSS in enhancing decision-making in higher education institutions. Convenience sampling was employed in this study and a questionnaire administered to 28 participants. These methods were chosen to gather insights into the practical application of AI technology in the context of IT operational decision-making. The major findings of this research reveal that AIDSS has the potential to significantly improve decision-making processes in higher education. Despite these advancements, the research acknowledges the ethical and societal implications arising from AI integration, underscoring the importance of achieving a balance between technical advancement and the upholding of human values. As a major policy implication, this study underscores the importance of embracing AI technologies in higher education institutions to enhance decision-making processes, thus improving the efficiency and effectiveness of IT operations. The original contribution of this research lies in its exploration of the practical use of AIDSS in South African higher education, offering insights into how AI can be harnessed to advance decision-making.

Keywords: artificial intelligence, higher education, decision-making, IT operations, data-driven decisions, South African university

Introduction

The integration of artificial intelligence (AI) into decision support systems (DSSs) has garnered significant attention in various fields, such as healthcare and medical domains. Holsapple (2008) has extensively explored how AI empowers DSSs by enhancing their ability to reason and provide recommendations to users. This integration of AI techniques has also found application in radiology DSSs, as exemplified by the works of Kahn (1994) and Walczak (2018). These studies showcase the utilization of AI methodologies that include rules-driven logic, neural network modelling, Bayesian systems, and reasoning based on case studies to aid physicians in selecting procedures and making accurate diagnoses. Despite similarities in decision-making complexity between healthcare and education, AI's potential to aid higher education institutions (HEIs) remains largely untapped. While AI has been successful in aiding medical professionals, its implementation in HEIs could improve operational efficiency and student outcomes. Bridging this gap necessitates addressing HEIs' unique challenges, such as resource constraints and organizational culture. By exploring tailored solutions, researchers and practitioners can unlock AI's transformative potential in higher education.

While AI's potential within DSSs has been extensively explored across various domains, there remains a notable scarcity of information regarding its application within the realm of HEIs on a global scale. This gap is particularly evident in the context of South Africa, where concerns about the cost-effectiveness of adopting advanced technology often prevail, given the limited resources available. In an effort to bridge this research void and illuminate the possibilities of AI within HEIs, Mekala, Mendoza, and Bosua (2015) introduced a novel DSS framework that capitalizes on data mining and association rule algorithms. This innovative approach aims to address some of the challenges faced by AI and DSSs when confronted with intricate decision-making processes. Additionally, Radzikowski (1984) proposes the application of linear goal programming as a viable framework for resolving decision-related issues within expert systems. The DSS architecture facilitates data integration, analysis, and visualization, enabling informed decision-making processes. Meanwhile, the linear goal programming technique optimizes resource allocation and operational efficiency by aligning institutional objectives with available resources. Together, these methodologies offer a systematic approach to navigate complexities within HEIs, promoting effective resource management, strategic planning, and improved outcomes in decision-making processes. This framework, with its potential adaptability, could offer significant improvements to decision-making processes within the context of HEIs.

Moser (1986) underscores the capabilities of expert systems, a subset of AI, in analyzing simulation outcomes and providing valuable recommendations to expert users. Such capabilities hold promise in academic settings where experts may require support in navigating complex decision-making scenarios. Furthermore, Eom et al. (1998) concludes that AI has made substantial

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contributions to the foundations of DSSs, including fundamental concepts, model management techniques, group support systems, and processes for multiple criteria decision-making. These contributions underscore the multifaceted role of AI in empowering DSSs across diverse domains, including higher education.

Nonetheless, despite these promising findings, a significant research gap persists concerning the practical application of AI within HEIs on a global scale, and concerns about its cost-effectiveness continue to linger, especially in the South African context. As exemplified by the works of Mekala, Mendoza, and Bosua (2015), Radzikowski (1984), Moser (1986), and Eom et al. (1998), AI demonstrates the potential to address these challenges effectively and enhance DSSs within higher education. Further exploration and investigation into AI's capabilities within HEIs are paramount to harnessing its benefits and effectively addressing the unique challenges encountered in this specific context.

AI significance in universities

The introduction of AI at universities has a significant impact in many ways. Firstly, AI stands poised to transform the landscape of learning experiences by providing personalized and optimized educational journeys for students (Crompton and Song 2021). This transformative potential is realized through the implementation of adaptive learning systems, which can adeptly cater to individual learning styles and paces, ultimately resulting in improved student outcomes. Furthermore, Tomar and Verma (2021) delve into the multifaceted role of AI technologies in higher education, encompassing teaching, learning, and research. They underscore the importance for educational institutions to maintain vigilance and control over AI algorithms to ensure their responsible and effective utilization.

Moreover, the influence of AI extends to the context of administrative efficiency within universities. These institutions often grapple with the complexities of extensive administrative tasks, but AI offers a solution by streamlining various processes. From managing admissions and enrolment to the distribution of financial aid, AI has the capacity to enhance overall operational efficiency while concurrently reducing the burden of administrative overhead (Lukianets and Lukianets 2023). Furthermore, AI empowers universities with data-driven decision-making capabilities, as it can analyze and interpret extensive datasets to provide valuable insights. This data-driven approach can lead to more effective resource allocation, improved student retention, and strategic planning. Moreover, AI fosters a culture of research and innovation, expediting discoveries and solutions across diverse fields. It accelerates scientific breakthroughs, aids in solving complex problems, and contributes to pioneering innovations (Jiao et al. 2020). Additionally, AI brings cost-saving opportunities by automating various university operations. For instance, automated chatbots can efficiently handle routine inquiries, potentially reducing the reliance on human staff in certain administrative roles. Lastly, universities embracing AI position themselves competitively on a global scale, becoming attractive hubs for top talent, researchers and students who seek access to cutting-edge technology and innovative educational experiences.

Research objectives

This research explores practical application of AI in higher education, addressing a need for empirical studies that explore the real-world implementation of AI-powered decision support system (AIDSS) on decision-making processes within universities. Focusing on the crucial area of IT operations within higher education, the study seeks to bridge a gap in the existing literature by investigating how AI can effectively enhance decision-making within ICT departments, ultimately contributing to improved operational efficiency.

This research focuses on the specific case of the ICT department within a selected South African university. It aims to explore how AI technology can be utilized to improve decision-making processes in higher education, particularly within the realm of IT operations. The study utilizes quantitative questionnaire for data collection.

The objective of the study is to:

1. Explore the practical application of AI-powered decision support system within the ICT department of a South African university.
2. Examine the potential benefits of AI in enhancing decision-making within the ICT department of a South African university.

The study seeks to make a contribution into the practical use of AI in higher education, particularly within ICT departments, and shed light on its implications, both in terms of efficiency and ethics, within the South African context. The research findings and implications of this study add to a broader comprehension of the role of AI in higher education decision-making and its potential policy implications.

Study setting

This research was carried out within a specific department at the University located in Alice, a town situated in South Africa. Alice town, as depicted on Figure 1, is positioned on the southwestern bank of Tyume River in the Eastern Cape province (Britannica 2023).

The province of Eastern Cape shares borders with the Western Cape province, the Northern Cape province and the KwaZulu-Natal province to its northeast.

The ICT department at the selected university provides a vital role in providing support to faculties, management, academics and administrative operations of the institution. The ICT department plays a pivotal role in managing the technological backbone of the university. This encompasses the oversight of critical components such as networks, servers, and computer systems, ensuring they remain current and dependable. Moreover, the department extends its support to the university community, offering technical assistance to students, faculty, and staff. This support encompasses addressing IT-related concerns, troubleshooting issues, and guaranteeing the seamless functioning of digital tools and services. In response to the evolving educational landscape, the

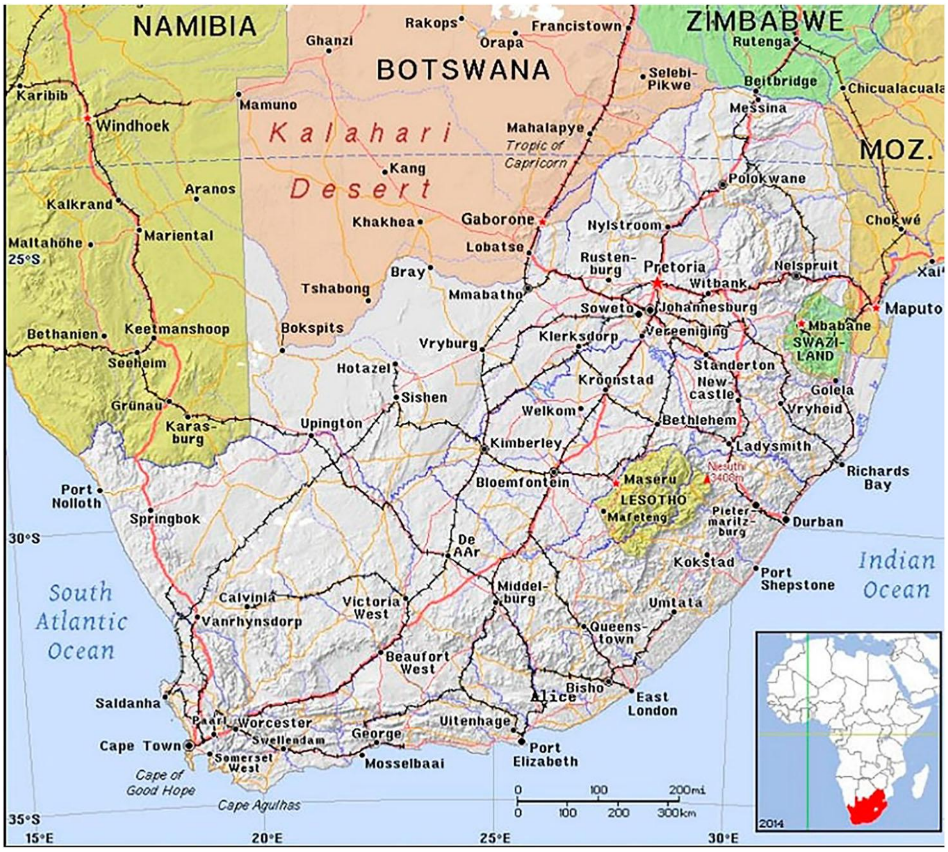

Figure 1: Map of South Africa.

ICT department has spearheaded e-learning initiatives. It has been instrumental in facilitating the university's transition to online and blended learning modalities, contributing to the institution's adaptability in a dynamic educational environment. Recognizing the significance of data security and management, the department assumes responsibility for safeguarding sensitive information. In its pursuit of innovation, the ICT department explores emerging technologies and solutions. These endeavours aim to enhance both educational and administrative processes, with a particular emphasis on harnessing the potential of AI and data analytics.

Furthermore, the department is committed to fostering digital literacy and IT proficiency among students and staff. To this end, it offers training and development programmes designed to empower individuals with essential IT skills. Collaboration with academic departments is another hallmark of the ICT department's mission. By working closely with these units, it ensures the seamless integration of technology into the curriculum. This collaborative effort guarantees that students have unfettered access to the tools and resources essential for their academic endeavours, aligning the university with the demands of a technology-driven era.

Literature review

The role of decision support systems in universities

The role of decision support systems (DSSs) in HEIs is crucial, especially considering the escalating demand for improved educational services and the rising operational costs they face worldwide (Bresfelean and Ghisoiu 2010). HEIs must effectively harness the data they collect, invest in data management tools, and embrace participatory decision-making that involves stakeholders like students, faculty, and the local community. DSS, primarily employed in business and management contexts, assume a crucial role in the conversion of unprocessed data into practical and implementable knowledge, aiding in decision-making processes, and enhancing resource management efficiency (Igwe and Nwele 2013). These systems summarize organizational information visually, such as through charts and graphs, aiding HEI management in strategic decision-making. Timely and effective decisions are crucial for the success of educational institutions, and DSS is instrumental in expediting decision-making processes and improving data analysis, especially in the face of intense competition (Shalabi and Shalabi 2020). The successful adoption of DSSs in the education sector is influenced by its proven success in other commercial domains (Naila and Imran 2014).

The advantages of DSSs in HEIs are multifaceted, encompassing a wide range of benefits that significantly enhance managerial processes and decision-making (Bresfelean and Ghisoiu 2010). In the modern educational landscape, HEIs have become increasingly dependent on digital technologies, which play a pivotal role in teaching, research, and administrative operations. Nevertheless, providing effective IT services within HEIs can pose challenges, often stemming from budget constraints and resource limitations. DSS effectively tackle these challenges by streamlining the intricate web of information systems that often operate in isolation. This integration not only enhances cohesion but also enables the efficient processing of complex data (Igwe and Nwele 2013). The benefits of DSSs within HEIs are indeed extensive, fostering a plethora of positive outcomes. These include heightened personal efficiency, accelerated decision-making processes, improved organizational control, and the facilitation of effective problem-solving. DSS also contribute to the promotion of efficient workplace communication, continuous employee learning and training, the cultivation of competitive advantages, the exploration of innovative problem-solving approaches, the automation of managerial procedures, the generation of novel and creative ideas, the elimination of redundant value-chain activities, and the encouragement of a culture of experimentation and learning (Igwe and Nwele 2013).

AI applications in higher education

Chatterjee and Bhattacharjee (2020) highlight the challenges plaguing the quality of higher education in low- and middle-income nations, including limited institutional independence, rigid educational structures, ineffective administrative processes, and insufficient financial support from both public and private sectors. Menon et al. (2014) concur that to address these issues and elevate higher education quality, there is an urgent call for a paradigm shift. AI and machine learning (ML) are viewed as integral in this transformation, offering various ways to enhance educational processes (Asthana and Hazela 2020; Liu et al. 2018). AI applications range from utilizing big data for forecasting and autonomous decision-making through deep learning and neural networks (Calegari et al. 2020) to natural language processing (NLP) for improved information retrieval (Bavakutty, Muhammed Salih, and Mohammed Haneefa 2006). Al-kmali et al. (2020) and Teng, Zhang, and Sun (2023) assert that leading HEIs worldwide, including those in the USA, Australia, and the UK are already leveraging AI and ML to streamline operations, enhance student experiences and improve decision-making. Such technologies alleviate administrative burdens on educators, empower students with innovative learning tools, and enable data-driven DSSs to optimize institutional performance (Kuleto et al. 2021; McKinsey & Company 2017).

In South African HEIs, the implementation of DSSs is critical to navigate the challenges brought by global competition and increased unpredictability (Bresfelean and Ghisoiu 2010). AI and ML offer a data-driven approach to decision-making, capable of handling vast volumes of information without human biases (Parry, Cohen, and Bhattacharya 2016). These technologies, already making strides in areas like intelligent tutoring systems, can personalize learning experiences, detect cognitive patterns, and reduce administrative burdens for educators (IIkka 2018; Mlambo-Ngcuka 2013). In IT operations, AI automates routine tasks, enhancing IT staff productivity and enabling a more analytical and data-driven approach to decision-making (Dejoux and Léon 2018). This transition from intuition-based decisions to AI-driven, data-centric choices equips the department to tackle dynamic challenges effectively (IIkka 2018). Ultimately, AI and ML hold the promise of transforming South African HEIs, optimizing operations, and elevating the quality of higher education.

Challenges in IT operations in higher education

There is limited information regarding the application of AI in HEIs globally, and concerns about the cost-effectiveness of established technology, such as individual tablets, persist in the South African context (Roberts and Vänskä 2011). Zawacki-Richter et al.'s (2019) review of studies conducted from 2007 to 2018 in the higher education sector revealed various facets of AI's role. While some papers critically assessed AI in education, others explored the correlation between teaching methods and data-driven systems. A few studies also raised concerns regarding the implications of using data and AI in educational settings. The integration of AI-enabled DSSs in South African HEIs has the potential to revolutionize decision-making by enabling data-driven, accurate, and efficient choices. Nevertheless, challenges such as ethical concerns, data quality, and the need for skilled personnel pose obstacles. To address these challenges, this study aims to continuously evaluate the benefits and risks of AI decision support in IT services, develop strategies, and establish policies for responsible and effective use. Collaboration among technical experts, institutional leaders, and stakeholders is essential for successful AI implementation. This collaborative effort can empower South African HEIs to harness AI's power for data-driven decisions and enhance IT services.

The study's implications extend to IT operations in higher education and other organizations aiming to implement AI Decision Support Systems (AIDSS). AI for IT Operations as described by Li et al. (2020), encompasses the use of HEIs and operational data to streamline software and system operations. AI for IT Operations (AIOps) integrates HEIs, big data analytics, and advanced AI techniques to enhance various IT operations, including monitoring, incident response, and performance optimization (Bhardwaj and Sabharwal 2022). By automating routine tasks, AIOps allows ICT departments to allocate more time to strategic projects, leading to reduced network downtime, improved system availability, and enhanced customer satisfaction (Dang, Lin, and Huang 2019). These systems analyze vast data sets using AI and HEIs to automate incident management, system provisioning, and change management (Gartner 2023). Understanding AIOps components is essential for a smooth integration of AI into ICT departments. Both AIOps and AIDSS leverage AI to improve decision-making and operational efficiency in HEIs, offering a comprehensive ecosystem for optimizing the ICT department's performance.

Prior research on AI and decision-making in academic institutions

In IT operations decision-makers face a multitude of challenges in their operational decision-making processes (Padayachee, Matthee, and van der Merwe 2017). Flexibility is paramount to adapt to rapidly evolving technology, enabling responses to dynamic shifts and emerging vulnerabilities. A user-centric approach, emphasizing alignment with user expectations, enhances operational efficiency. Efficient resource allocation is vital for optimizing solutions while staying within budget constraints.

Lutz, Boucher, and Roustant (2013) concur that data-driven insights and collaborative decision-making are on the rise, bolstering accuracy and harnessing collective wisdom. Systematic frameworks and structured approaches ensure consistency and prevent ad-hoc decisions. Data collection and analysis, along with evaluating alternatives, guide choices and stakeholder involvement enriches decision-making. Risk mitigation is crucial to address uncertainties, and decisions are aligned with organizational goals. Yet, budget limitations challenge resource allocation, and the intricate technological landscape demands constant vigilance, while uncertainty and the need for risk management in rapidly changing environments pose formidable hurdles for decision-makers in the ICT department.

Research methodology

The primary objective of this research is to gain a comprehensive understanding of how AIDSS influences decision-making within the ICT department of a selected South African university. This study adopts a case study approach, focusing on this specific university as a representative example. Participants were introduced to a prototype AIDSS featuring business automation, preventive asset maintenance and predictive analytics functionality. Following this introduction, participants were provided with a structured questionnaire aimed at assessing their perceptions regarding the adoption and utilization of AIDSS. The questionnaire utilized in this study was derived from the work of Kao et al. (2016) and was further enhanced by incorporating supplementary inquiries. Through this questionnaire, valuable information and perspectives were gathered, shedding light on the practical implications and potential improvements in the implementation of AIDSS in the selected university.

Data analysis techniques

The research was carried out within a specific department of the university located in Alice town, South Africa. The study population comprised individuals holding key decision-making roles within the ICT department. Convenience sampling was employed to select participants for the study. Convenience sampling enabled the researcher to conveniently select decision-makers in the ICT department for the study. The questionnaires were distributed among IT staff members, both males and females with a total of 30 questionnaires handed out. The questionnaire is on Appendix A. Ultimately 28 IT staff members participated in the study resulting in a response rate of 93.33%. It is worth mentioning that all returned questionnaires were considered valid. Subsequently, the collected data went through analysis and the results were statistically analyzed using the SPSS statistical software to facilitate comprehensive interpretation and understanding of the findings. The analysis and discussion of the questionnaire's results assess the extent to which each AIDSS construct influenced IT staff satisfaction in the context of the case university. To determine the strength of the relationship between the variables a Pearson correlation method was used. This approach allowed for a detailed exploration of the decision-making processes within the ICT department.

Ethical clearance

The study received ethical approval with the reference number 200608029/2022/23 from the Research Ethics Committee at the Cape Peninsula University of Technology.

Results and insights from questionnaire

A central theme of this research revolves around AI's capacity to facilitate data-driven decision-making, as such participants were asked to evaluate a prototype artificial intelligence-enabled decision support system (AIDSS) for operational decision-making in the ICT department. User perceptions and experiences were gathered to gain an understanding of how AIDSS affects decision-making in the ICT department. This process provided valuable insights into the effectiveness and performance of the AIDSS. The questionnaires were structured in a way that is relative to the experience of the participants and their receptiveness of AIDSS. The questionnaire had demographic section and closed ended questions which allowed the employees to select a box that had an answer that they agreed with.

The questions were divided into five constructs according to the study objectives: Decision Support (Questions 7, 14, 15, 19, 20, 22, 23) as the dependent variable and Efficiency (Questions 10, 11, 12), Integration (Questions 6, 8, 9, 21), User satisfaction (Questions 1–5, 24, 25), and Scalability (Questions 13, 16, 17, 18) as the independent variables of the study. These constructs shed light on the practical application of AI, offering insights into its potential benefits for enhancing decision-making within the ICT department of a South African university. This study investigates the practical implementation of AI decision support in the ICT department of a South African university. It seeks to uncover the tangible ways in which AI can be utilized in real-world scenarios to aid decision-making processes in this specific academic context.

Demographic distribution

In this section, we present a comprehensive overview of the data and results that have been gathered and analyzed in the context of this study. This study investigates the practical implementation of AI-powered decision support system in the ICT department of a South African university. It seeks to uncover the tangible ways in which AI can be utilized in real-world scenarios to aid decision-making processes in this specific academic context. The dataset comprises various components, including demographic parameters, as well as the perceptions and insights of the study participants. The analysis involves a thorough examination of this data, allowing for meaningful comparisons and informed inferences. In this study comparisons based on gender, age, job position, length of service within the organization, and educational level provide valuable insights into the dynamics of AIDSS utilization within the selected HEI. Analyzing usage patterns and perceptions across genders helps identify potential differences in technology adoption and user experiences. Similarly, examining AIDSS usage among different age groups reveals generational preferences and adoption barriers. Comparing usage across job positions identifies decision-makers who can contribute to AIDSS implementation. Understanding how length of service influences usage sheds light on the role of organizational tenure in technology adoption and user engagement. Lastly, exploring AIDSS usage by educational level illuminates the relationship between academic qualifications, technological proficiency, and decision-making capabilities. These comparisons enrich our understanding of AIDSS utilization within HEIs. Through these comparisons, the study aims to provide a comprehensive understanding on the implications and significance of the collected data.

Table 1 serves as crucial data to understanding the composition of the study's participant demographics. One of the noteworthy observations is the gender distribution, with a significantly higher representation of male participants, comprising 78.6% ($n = 22$) of the total sample. In contrast, female participants constitute a smaller fraction, amounting to 21.4% ($n = 6$). This gender disparity within the sample could potentially shed light on gender-related perceptions and attitudes towards AI-enabled DSSs in the ICT department.

Age plays a substantial role in this study's demographic landscape, revealing distinct age groups among the participants. A substantial majority falls within the age bracket of 29–39 years, accounting for 57.1% ($n = 16$) of the respondents. This age group's prominence may be indicative of a tech-savvy generation, potentially more receptive to AI technologies. The 40–49 years age category also exhibits a significant presence, making up 28.6% ($n = 8$) of the participants. Meanwhile, the 18–28 years and 50–59 years age groups each constitute a smaller, albeit noteworthy, 7.1% ($n = 2$) of the sample. These age-based distinctions could uncover generational differences in the perception and adoption of AI in educational institutions.

Table 1: Demographics of participants.

Characteristics	Frequency	Per cent
Gender		
Female	6	21.4
Male	22	78.6
Age		
18–28 years	2	7.1
29–39 years	16	57.1
40–49 years	8	28.6
50–59 years	2	7.1
Position		
Admin Staff	2	7.1
Technical Staff	12	42.9
Supervisor	7	25.0
Manager	7	25.0
Years in Organization		
7 months–2 years	7	25.0
3–5 years	7	25.0
6–8 years	6	21.4
9 years or more	8	28.6
Study Level		
Undergraduate	12	42.9
Honours	10	35.7
Masters	6	21.4

Exploring the participants' positions within the university's hierarchy yields valuable insights. A substantial portion, 42.9% ($n = 12$), holds technical staff positions, underlining their potential involvement in the implementation and utilization of AI systems. Supervisors and managers collectively constitute another 50% ($n = 14$) of the participants, highlighting the relevance of decision support in their administrative roles. On the other hand, administrative staff make up the smallest portion at 7.1% ($n = 2$). These positional disparities are integral to understanding how various segments of the workforce view the impact of AI on operational decision-making.

A crucial dimension of the participants' profiles is their tenure within the organization. Notably, a significant percentage of respondents, 28.6% ($n = 8$), have dedicated nine or more years to the university. These long-serving individuals may possess valuable institutional knowledge, potentially influencing their perspectives on AI adoption. Equally significant, 25% ($n = 7$) of the participants fall into the 3–5 years and 7 months–2 years' experience categories, offering insights into the views of relatively newer members of the university community. Lastly, 21.4% ($n = 6$) of respondents have a tenure of 6–8 years. Understanding the diverse experiences of these individuals is vital in comprehending the nuances of AI implementation within the university's ICT department. Consequently, the demographic characteristics revealed in Table 1 provide a rich backdrop against which to interpret the data and perceptions gathered in this study. These demographics illuminate potential variations in viewpoints and attitudes towards the AIDSS within the ICT department, considering factors such as gender, age, position, and organizational tenure (Table 2).

The scale for expressing levels of agreement or disagreement is as follows: Strongly Disagree (SD) is assigned a value of 1, Disagree (D) is assigned a value of 2, Neutral (N) is assigned a value of 3, Agree (A) is assigned a value of 4, and Strongly Agree (SA) is assigned a value of 5.

In the context of Scalability, participants' responses were generally positive. Specifically, for 'Satisfaction with the system's speed and responsiveness' ($M = 4.21$, $STD = .686$), Question 'System's early detection of potential problems through predictive analytics positively impacted ICT operations' ($M = 4.07$, $STD = .766$), 'System successfully predicted and prevented impending ICT issues before they escalated' ($M = 4.11$, $STD = .737$), and 'Confidence in the system's predictive analytics for detecting potential future problems within the ICT operations' ($M = 4.14$, $STD = .705$), respondents reported favourable experiences. The relatively low standard deviations accompanying these means indicate a consistent and favourable perception of the AIDSS Scalability aspect. Participants feedback show that they are highly satisfied with how the system responds and its ability to provide analytics. These aspects greatly contribute to improving ICT operations. The overall agreement among participants emphasizes the role Scalability plays in shaping their experiences and opinions about the systems effectiveness.

Table 2: Staff perception towards AIDSS.

Item	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean (M)	Std. Deviation (SD)
Scalability							
I am satisfied with the system's speed and responsiveness	–	–	14,3	50,0	35,7	4.21	.686
System's early detection of potential problems through predictive analytics positively impacted ICT operations	–	3,60	14,3	53,6	28,6	4.07	.766
System successfully predicted and prevented impending ICT issues before they escalated	–	–	21,4	46,4	32,1	4.11	.737
I have confidence in the system's predictive analytics for detecting potential future problems within the ICT operations	–	–	17,9	50,0	32,1	4.14	.705
User Satisfaction							
The system is easy to use	–	–	25,0	53,6	21,4	3.96	.693
The system helps me make decisions efficiently	–	–	17,9	60,7	21,4	4.04	.637
The system helps me make decisions quickly	–	–	25,0	42,9	32,1	4.07	.766
The system helps me make decisions effectively	–	–	28,6	64,3	7,1	3.79	.568
The system interface is easy to use	–	–	32,1	50,0	17,9	3.86	.705
Overall, the system is easy to use	3,6	7,1	10,7	50,0	28,6	3.93	1.016
Overall, I am satisfied with the system	–	3,6	17,9	53,6	25,0	4.00	.770
Integration							
System integrates existing decision-making processes or tools	10,7	3,6	25,0	35,7	25,0	3.61	1.227
The system complemented the skills and expertise of ICT personnel	-	3,6	14,3	46,4	35,7	4.14	.803
I believe I have learned how to operate the system	-	3,6	21,4	28,6	46,4	4.18	.905
I would recommend the system to others for decision-making purposes	-	3,6	32,1	42,9	21,4	3.82	.819
Efficiency							
The system provides appropriate error messages and clear instructions of how to address errors	7,1	10,7	39,3	25,0	17,9	3.36	1.129
The system improved optimization of resource allocation	-	7,1	10,7	60,7	21,4	3.96	.793
The system minimized resource wastage	-	3,6	14,3	53,6	28,6	4.07	.766
Decision Support System (DSS)							
I am comfortable with the data being collected and stored by the system for decision-making purposes	3,6	3,6	28,6	28,6	35,7	3.89	1.066
The system provides information that helps me make decisions effectively	-	3,6	28,6	50,0	17,9	3.82	.772
The system assists me in my day-to-day tasks and responsibilities	-	7,1	7,1	46,4	39,3	4.18	.863
The system provides easily understood information	-	7,1	25,0	32,1	35,7	3.96	.962
The system's chat feature assists me to make decisions	-	14,3	14,3	35,7	35,7	3.93	1.052
I would recommend the system to others for decision-making purposes	-	3,6	14,3	64,3	17,9	3.96	.693
The system had all expected functions and abilities	3,6	14,3	21,4	53,6	7,1	3.46	.962

For User Satisfaction construct, participants provided ratings with an average of ($M = 3.96$, $STD = .693$) for 'The system is easy to use', ($M = 4.04$, $STD = .637$) for 'The system helps make decisions efficiently', ($M = 4.07$, $STD = .766$) for 'The system helps make decisions quickly', ($M = 3.79$, $STD = .568$) for 'The system helps make decisions effectively', ($M = 3.86$, $STD = .705$) for 'The system interface is easy to use', ($M = 3.93$, $STD = 1.016$) for 'Overall, the system is easy to use', and ($M = 4.00$, $STD = .770$) for 'Overall, I am satisfied with the system'. These statistics indicate varying levels of efficiency perception among participants regarding the AIDSS usability and effectiveness in decision-making. While some participants acknowledge the ease of use and efficiency, others express varying degrees of satisfaction and effectiveness.

Concerning Integration, the participants rated their experiences as ($M = 3.61$, $STD = 1.227$) for 'System integrates existing decision-making processes or tools', ($M = 4.14$, $STD = .803$) for 'The system complemented the skills and expertise of ICT personnel', ($M = 4.18$, $STD = .905$) for 'Learned how to operate the system', and ($M = 3.82$, $STD = .819$) for 'Recommend the system to others for decision-making purposes'. These statistics highlight diverse opinions among participants regarding user satisfaction. While some participants recognize that the prototype complements the skills of ICT personnel and are willing to recommend it there is variation in their perspectives. This diversity emphasizes the importance of considering experiences and preferences when evaluating user satisfaction in relation to system integration.

In terms of Efficiency, respondents reported their perceptions with ($M = 3.36$, $STD = 1.129$) for 'The system provides appropriate error messages and clear instructions of how to address errors', ($M = 3.96$, $STD = .793$) for 'The system improved optimization of resource allocation', and ($M = 4.07$, $STD = .766$) for 'The system minimized resource wastage'. These results indicate varying levels of integration-related experiences. These findings highlight the diversity of experiences related to the system's efficiency. While some respondents appreciate the AIDSS role in minimizing resource wastage and improving resource allocation, others may have different perspectives.

Lastly, under the Decision Support construct, participants expressed their views with ($M = 3.89$, $STD = 1.066$) for 'I am comfortable with the data being collected and stored by the system for decision-making purposes', ($M = 3.82$, $STD = .772$) for 'The system provides information that helps make decisions effectively', ($M = 4.18$, $STD = .863$) for Question 15, ($M = 3.96$, $STD = .962$) for 'The system provides easily understood information', ($M = 3.93$, $STD = 1.052$) for 'The system's feature assists to make decisions', ($M = 3.96$, $STD = .693$) for 'I would recommend the system to others for decision-making purposes', and ($M = 3.46$, $STD = .962$) for 'The system had all expected functions and abilities'. These statistics illustrate diverse perceptions regarding Decision Support among the study participants. The construct reflect the variability in participants' perspectives concerning the AIDSS functionality and effectiveness in aiding decision-making.

Reliability of variables

The reliability of the instrument used in the study was thoroughly assessed by examining Cronbach's alpha for each construct. The results, which are summarized in Table 3 revealed that all constructs had Cronbach's alpha values, above the threshold of 0.7. This indicates consistency and reliability consistent with established research guidelines (Hair et al. 1998).

The reliability and internal consistency of the five constructs were assessed using a statistical measure called Cronbach's alpha, which is commonly employed in research to determine the reliability of a scale or questionnaire. Cronbach's alpha assesses how well the items within a construct consistently measure the same underlying concept. In this context, the study examined five constructs: Decision Support, Efficiency, Integration, Scalability, and User Satisfaction.

Decision Support: This construct comprises five items that are designed to measure the effectiveness and reliability of the decision support. The Cronbach's alpha value for this construct is .71, indicating an acceptable level of internal consistency. This means that the items within this construct, when taken together, consistently measure the concept of decision support.

Efficiency: The Efficiency construct is composed of two items, focusing on the efficiency of the system's operations. Similar to the Decision Support construct, the Cronbach's alpha value for Efficiency is .71, indicating acceptable internal consistency. This implies that the two items in this construct reliably measure the concept of efficiency.

Integration: The Integration construct consists of two items, which aim to evaluate the level of integration within the system. However, this construct displays relatively weaker internal consistency, with a Cronbach's alpha value of .54. This suggests that the items in the Integration construct may not consistently measure the concept of integration, and there may be room for improvement or the addition of new items to enhance their reliability.

Scalability: The Scalability construct includes four items that assess the system's ability to scale up and handle increased demands. This construct demonstrates strong internal consistency, as reflected by a Cronbach's alpha value of .80. The high value indicates that the four items within the Scalability construct consistently measure the concept of scalability.

User Satisfaction: The User Satisfaction construct is the most extensive, consisting of seven items aimed at gauging user satisfaction with the system. This construct exhibits strong internal consistency, with a Cronbach's alpha value of .82. This implies that all seven items reliably measure the concept of user satisfaction, demonstrating a high level of consistency within AIDSS.

Correlation analysis

The analysis was performed using Pearson product moment correlation coefficients to measure relationship between Efficiency, Scalability, User Satisfaction, Integration and Decision Support. This method helps to understand how two continuous variables are related and is represented by a p value. The Pearson correlation coefficient is appropriate when it can be assumed that the variables follow a distribution. The p value informs the significance of the correlation coefficient. Typically, a p value below 0.05 is considered significant indicating a relationship between the variables. On the hand if the p value is higher than 0.05 it suggests that there is no relationship between the variables. Tables 4 to 7 display any differences found between these variables based on their p values; values below 5% (p value < 0.05) indicate statistically significant findings while values, above 5% (p value > 0.05) indicate statistically insignificant findings. These findings inform the understanding of how these factors interact and influence the effectiveness of the AIDSS in supporting operational decision-making within the selected university's ICT department.

Table 4 shows the correlation among Decision Support, Scalability, User Satisfaction, Integration and Efficiency. There is no significant correlation between Decision Support and User Satisfaction (p-value > 0.05). This means that having a decision support does not necessarily lead to increased user satisfaction. There is a moderate correlation between Decision Support and Scalability (p-value < 0.05). This means that decision support tends to be more scalable than other types of software. There is a significant correlation between Decision Support and Integration (p-value < 0.05). This means

Table 3: Reliability statistics.

Construct	Number of Items	Cronbach's alpha	Internal consistency
Decision Support System	5	.71	Acceptable
Efficiency	2	.71	Acceptable
Integration	2	.54	Poor
Scalability	4	.80	Good
User Satisfaction	7	.82	Good

Table 4: Decision Support System.

		Scalability	User Satisfaction	Integration	Efficiency
Decision Support System	Pearson Correlation	.556**	0.353	.504**	.668**
	Sig. (2-tailed)	0.002	0.065	0.006	0.000
	N	28	28	28	28

Note: **Correlation is significant at the 0.01 level (2-tailed).

Table 5: Efficiency.

		Scalability	User Satisfaction	Integration	Decision Support System
Efficiency	Pearson Correlation	.446*	−0.049	.403*	.668**
	Sig. (2-tailed)	0.017	0.803	0.033	0.000
	N	28	28	28	28

*Correlation is significant at the 0.05 level (2-tailed); **correlation is significant at the 0.01 level (2-tailed).

Table 6: Integration.

		Scalability	User Satisfaction	Efficiency	Decision Support System
Integration	Pearson Correlation	0.353	.575**	.403*	.504**
	Sig. (2-tailed)	0.065	0.001	0.033	0.006
	N	28	28	28	28

*Correlation is significant at the 0.05 level (2-tailed); **correlation is significant at the 0.01 level (2-tailed).

that decision support is often integrated with other types of software. There is a significant correlation between Decision Support and Efficiency (p-value < 0.05). This means that decision support can help businesses to operate more efficiently. These findings underscore the multifaceted relationships among decision support, scalability, integration, efficiency, and user satisfaction in the ICT operational decision-making process.

Table 5 reveals that there are statistically significant correlations between efficiency and scalability (p-value = 0.017), efficiency and integration (p = 0.033), and efficiency and decision support (p-value = 0.000). This means that AIDSS prototype is more scalable, integrated, and have decision support is more likely to be efficient. However, the correlation between efficiency and user satisfaction is negative and not statistically significant (p-value = 0.803). This means that there is no clear relationship between efficiency and user satisfaction. It is like that additional elements may exert a greater influence in determining user satisfaction. Therefore, the results suggests that efficiency is important for participants, but it is not the only factor that determines the AIDSS success, it should also focus on other factors, such as scalability and integration. In essence, while efficiency is important, the AIDSS should also prioritize factors like scalability and integration to ensure overall success and user satisfaction within the ICT department.

The results depicted in Table 6 reveal several noteworthy insights. Firstly, there exists a statistically significant relationship between Integration, User Satisfaction, Efficiency, and Decision Support, as evidenced by p-values of 0.001, 0.033, and 0.006, respectively. This suggests that changes or variations in these variables have a statistically significant impact on one another for the AIDSS. Nevertheless, it is vital to emphasize that the outcomes do not demonstrate a statistically significant relationship between Integration and Scalability. In other words, changes in Integration do not have a statistically significant influence on Scalability, and vice versa. It is evident that Integration, User Satisfaction, Efficiency, and Decision Support are closely interconnected, while Integration and Scalability appear to be independent of each other. Therefore, while integration, user satisfaction, efficiency, and decision support capabilities are closely interconnected and should be prioritized for improvement, scalability should be addressed as a separate consideration in the implementation of the AIDSS within the ICT department of the selected university.

As per Table 7, there is a positive correlation between user satisfaction and integration, which is statistically significant (p-value = 0.001). This means that businesses that have better integration between their systems tend to have more satisfied users. There is a positive correlation between user satisfaction and scalability, which is also statistically significant (p-value = 0.034). This means that businesses that are more scalable tend to have more satisfied users. The fact that there is no significant correlation between user satisfaction and efficiency (p-value = 0.803) and user satisfaction and decision support (p-value = 0.065) suggests that these factors are not the primary

Table 7: User Satisfaction.

		Scalability	Integration	Efficiency	Decision Support System
User Satisfaction	Pearson Correlation	.401*	.575**	−0.049	0.353
	Sig. (2-tailed)	0.034	0.001	0.803	0.065
	N	28	28	28	28

*Correlation is significant at the 0.05 level (2-tailed).

determinants of user satisfaction. Therefore, the focus should be on optimizing integration and scalability to enhance user satisfaction and improve the overall effectiveness of the AIDSS in supporting operational decision-making within the ICT department of the university.

Table 8 shows that there is a statistically significant positive correlation between Scalability and User Satisfaction, as indicated by a *p*-value of 0.034. This suggests that as Scalability increases or decreases, it has a significant impact on User Satisfaction on the AIDSS. Similarly, a statistically significant positive correlation is observed between Scalability and Efficiency, with a *p*-value of 0.017. This implies that changes in Scalability are associated with significant variations in Efficiency, highlighting their interdependence. Furthermore, the analysis demonstrates a statistically significant positive correlation between Scalability and Decision Support, with a low *p*-value of 0.003. This indicates that Scalability performs a significant function in influencing the effectiveness of the Decision Support. However, when examining the relationship between Scalability and Integration, the analysis does not yield statistically significant results, with a *p*-value of 0.065. While there is a positive correlation, it is of moderate strength and lacks the statistical significance observed in the other relationships.

Scalability emerges as a significant determinant of AIDSS effectiveness, with scalable systems capable of accommodating growth and evolving requirements, thereby enhancing User Satisfaction. Integration plays a pivotal role, as AIDSS with seamless system integration tend to yield higher levels of User Satisfaction, emphasizing the importance of interoperability within the ICT environment. Efficiency remains a key concern, reflecting users' appreciation for systems that optimize processes and boost productivity. User Satisfaction itself emerges as a critical measure of AIDSS success, influenced by factors like Scalability, Integration, and Efficiency. Additionally, the study reaffirms the potential of AIDSS to enhance overall operational efficiency within universities, making data-driven decision support a transformative element. In essence, these findings underscore the multifaceted role these factors play in shaping the success and impact of AIDSS in university ICT operations.

Practical application of AIDSS within the ICT department

The findings assert that traditional incident management process at the case university can be improved by integrating automation and AI-driven solutions. This will lead to efficiency gains, faster response times, and better-quality incident management. AIDSS can also help academic institutions optimize resource utilization such as human resources and technological assets. This can make the university more efficient and sustainable. The findings of the research underscore the possible ramifications of AI-powered network management solutions, particularly in the context of scalability and optimization of network operations. These cutting-edge solutions can introduce an element of automation and intelligent task handling that can significantly impact the efficiency of network management. By harnessing AI algorithms, these tools maintain a constant watch over network traffic and device performance, swiftly identifying both patterns and anomalies that might elude human administrators. Furthermore, AI's robust data analysis capabilities can empower universities to take a proactive approach to network events, improving scalability and enabling more efficient resource allocation. In essence, AIDSS can provide a holistic framework for institutions to enhance scalability, streamline operations, and foster sustainable growth.

Universities can strategically leverage the potential of AI to transform their decision-making processes through the implementation of chatbots. By incorporating AI-driven chatbots, universities can introduce systems that excel in comprehending and processing user requests with remarkable ease and intuitive understanding of natural language. The integration of chatbots into IT operations holds the promise of significantly reducing the dependence on manual interventions, thereby expediting service delivery to unprecedented levels. Through the automation of chatbots and decision-making tasks, AI systems demonstrate the capability to simultaneously handle a substantial influx of requests, resulting in significantly reduced response times and an overall enhancement of operational efficiency. Moreover, AI chatbots possess the invaluable attribute of continuous learning and adaptation based on user interactions and feedback, perpetually refining their performance and accuracy as they evolve. This iterative learning process ensures that AI-driven chatbot automation progressively attains higher proficiency, seamlessly aligning with the ever-evolving needs and expectations of the university community.

Benefits of AIDSS in enhancing decision-making within the ICT department

Based on the findings the conclusion to be drawn is that the incorporation of AI Decision Support Systems within university ICT departments is extremely important because of the advantages they bring to decision making processes. These systems offer benefits to ICT operations, such as scalability, integration, efficiency and user satisfaction. Scalability ensures that AIDSS can easily adapt

Table 8: Scalability.

		User Satisfaction	Integration	Efficiency	Decision Support System
Scalability	Pearson Correlation	.401*	0.353	.446*	.556**
	Sig. (2-tailed)	0.034	0.065	0.017	0.002
	N	28	28	28	28

*Correlation is significant at the 0.05 level (2-tailed); **correlation is significant at the 0.01 level (2-tailed).

to changing user needs and data volumes which helps build trust and satisfaction among users. The strong integration capabilities of these systems make them user friendly and efficient for decision support ultimately improving the user experience. Efficiency plays a role in enabling accurate decision making in the dynamic ICT environment. Furthermore, AIDSS can improve overall ICT operations through data driven decision support.

Conclusion

The demographic data and user perceptions uncovered in the study hold practical implications for the implementation of AI-enabled decision support systems within the ICT department at the selected university. Understanding how factors like gender, age, job position, tenure, and educational level influence AI usage provides insights into user preferences, technological literacy, and adoption barriers. This knowledge informs targeted interventions, interface customization, and training initiatives tailored to meet the diverse needs of stakeholders and decision-makers. By aligning AI implementation strategies with user demographics and perceptions, organizations can enhance user engagement, optimize decision-making processes, and maximize the effectiveness of AI-enabled decision support systems within the ICT department at the selected university.

The study has revealed the relationships involving Decision Support (dependent variable) and its interactions with Scalability, User Satisfaction, Efficiency, and Integration (independent variables). The results suggests that decision support is a valuable tool for organizations, but it should be carefully selected and implemented in order to maximize institutional benefits. The statistical significance and strength of these correlations provide valuable insights into the dynamics of these variables towards the AIDSS. The research findings highlight the essential strategic considerations necessary for effectively leveraging AIDSS in decision-making within university ICT departments. With the increasing complexity and size of university IT infrastructures, conventional decision-making methods encounter significant hurdles, particularly in terms of scalability, efficiency, and the ability to respond promptly to potential network issues. Embracing AI-powered solutions emerges as a pivotal strategy to tackle these challenges head-on and enhance the decision-making processes within academic institutions. The motivation for leveraging AIDSS for enhanced IT Operations is evident in the study's results, which show that users highly appreciate systems that optimize processes and enhance productivity, aligning their expectations with AIDSS that prioritize efficiency. User satisfaction serves as a key measure of AIDSS success, as it is influenced by factors such as scalability, integration, and efficiency. Therefore, ensuring user satisfaction with system performance is vital for achieving long-term success and widespread adoption.

Further studies

Opportunities for further research lie in conducting more comprehensive investigations with larger and more diverse samples to establish causal relationships between decision support and various variables in the development of AIDSS. In future studies it would be valuable to expand the scope beyond a single department in order to capture a wider range of perspectives and experiences. Furthermore, utilizing mixed research methods could provide a more comprehensive understanding of the complex dynamics between AIDSS and decision-making processes. Additionally conducting case studies involving multiple universities may offer insights into how findings can be generalized and shed light on regional variations in AIDSS implementation and its impact. These avenues for further research hold the potential to contribute significantly to the evolving landscape of AI-driven DSSs in the context of higher education.

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No potential conflict of interest was reported by the authors.

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Appendix A

Questionnaire

Artificial Intelligence-powered decision support system for operational decision-making in the ICT Department of a Selected African University

Demographic Information

1	Gender	Female	Male			
2	Age	>18–28	29–39	40–49	50–59	>60
3	Position	Admin staff	Technical staff	Supervisor	Manager	Director
4	Years in organization	0–6 months	7 months – 2 years	3 years – 5 years	6 years – 8 years	9 years or more
5	Study level	High school	Undergrad	Honours	Masters	Doctorate

For each statement, please select a response that best reflects your opinion and experience.

No	Statements Please rank the following by crossing the most applicable. The weightings are; 1 – strongly disagree, 2 – disagree, 3 – neutral, 4 – agree, and 5 – strongly agree	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	The system is easy to use	1	2	3	4	5
2	The system helps me make decisions efficiently	1	2	3	4	5
3	The system helps me make decisions quickly	1	2	3	4	5
4	The system helps me make decisions effectively	1	2	3	4	5
5	The system interface is easy to use	1	2	3	4	5
6	System integrates existing decision-making processes or tools	1	2	3	4	5
7	I am comfortable with the data being collected and stored by the system for decision-making purposes	1	2	3	4	5
8	The system complemented the skills and expertise of ICT personnel	1	2	3	4	5
9	I believe I have learned how to operate the system	1	2	3	4	5
10	The system provides appropriate error messages and clear instructions of how to address errors	1	2	3	4	5
11	The system improved optimization of resource allocation	1	2	3	4	5
12	The system minimized resource wastage	1	2	3	4	5
13	I am satisfied with the system's speed and responsiveness	1	2	3	4	5
14	The system provides information that helps me make decisions effectively	1	2	3	4	5
15	The system assists me in my day-to-day tasks and responsibilities	1	2	3	4	5
16	System's early detection of potential problems through predictive analytics positively impacted ICT operations	1	2	3	4	5
17	System successfully predicted and prevented impending ICT issues before they escalated	1	2	3	4	5
18	I have confidence in the system's predictive analytics for detecting potential future problems within the ICT operations	1	2	3	4	5
19	The system provides easily understood information	1	2	3	4	5
20	The system's chat feature assists me to make decisions	1	2	3	4	5
21	The system has improved the quality of my decision-making process	1	2	3	4	5
22	I would recommend the system to others for decision-making purposes	1	2	3	4	5
23	The system had all expected functions and abilities	1	2	3	4	5
24	Overall, the system is easy to use	1	2	3	4	5
25	Overall, I am satisfied with the system	1	2	3	4	5