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The influence of system quality, information quality, and service quality on the net benefit of academic information systems with user satisfaction as an intervening variable

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ABSTRACT

The increasing interest of young people to occupy tertiary institutions of education, the higher the level of competition that exists. Therefore, every tertiary institution is competing to improve the quality of education by developing Student Portal. This study aims to determine how the influence of system quality, information quality, and service quality on net benefits mediated by student portal user satisfaction. This research was conducted by collecting 59 primary data of respondents through a questionnaire. The analytical test tool used SmartPLS v.3.2.7 with the SEM (Structural Equation Modeling) analysis method. The results of this study indicate that the quality of information and service quality has an influence on student portal user satisfaction, user satisfaction has an influence on net benefits, while the effect of system quality on user satisfaction cannot be proven statistically. In this situation, system quality, information quality, and service quality have a weak effect on net benefits with user satisfaction as a mediating variable.

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Introduction

In the 4.0 era, technological advancements are exponentially increasing and inevitable (Halili, 2019; Kalgren et al., 2006). Technological advancements profoundly influence every aspect of life, including in the world of education (Li et al., 2020). Technological development can bring advantages in providing information more quickly. Nevertheless, not all disseminated information maintains high quality. Internet users need to doubt the truth because too much information is received, leading to an inability to discern the genuine and valuable from the spurious (Fuentelsaz et al., 2019; van Prooijen et al., 2022).

The increasing interest of young people to occupy tertiary institutions, the higher the level of competition that exists (Candiwan, Sari, P., & N, 2016; Chowdhury et al., 2019). Therefore, every tertiary institution tries to compete in improving the quality of education. One strategy in improving the quality of education is to develop an information system. In tertiary institutions, students are required to be more proactive than when they were in school (Bosma et al., 2018). Proactive means

that students take the initiative to study material while simultaneously seeking information related to lectures independently (Abdelnour et al., 2017; Mishchenko et al., 2021).

However, there are so many students in a college, making information dissemination difficult to do manually. In this current condition, higher education cannot be separated from the use of information technology (Donges et al., 2023; Petracca & Gallagher, 2020). Therefore, higher education institutions utilize information technology to disseminate information to their students regarding lectures using the student portal. It is used as a means of information and communication between lecturers and students (Caeiro & Azeiteiro, 2020; Rodríguez-Pose, 2020).

A private university in Bandung has created a website. This website is used for online attendance, management of each student's academic data, filling in the Study Plan Form (FRS), updating student grade transcripts, as well as providing important announcements during lectures or announcements regarding job opportunities in companies. The increasing complexity of student portal's development necessitates an orientation towards the clear benefit of the student portals and user satisfaction, where in this case, the students themselves, as one of the methods to measure the effectiveness of the information system.

Several previous studies utilized the DeLone and McLean models in evaluating the success of academic information systems in tertiary institutions. In this model, six variables in measuring the success of a system are used, namely system quality, information quality, service quality, intention to use, user satisfaction, and net benefits (William H. DeLon & Ephraim R. McLean, 2003).

Meilani et al. (2020) succeeded in proving that information quality, system quality and service quality had a positive-significant influence on user satisfaction at Universitas Sultan Ageng Tirtayasa. The research findings of Hami & Anggraini (2022) also indicate that system quality, information quality, and service quality have a positive and significant influence on user satisfaction in the SIAKAD (Academic Information System) of STMIK Bani Saleh. However, research conducted by Panjaitan et al. (2019) showed different results. Research conducted on population administration information systems shows that system quality has no and not significant influence on user satisfaction and it has a negative and not significant influence on net benefits.

Several complaints were found from students regarding the student portal, such as a system that has errors when taking online attendance, resulting that it takes longer to make attendance. In addition, the system has an error when filling out the Study Plan Form (FRS), so it doesn't get the class quota of the desired course. Based on this gap, the aim of this research is to determine the influence of system quality, information quality, and service quality on the net benefit of academic information systems with user satisfaction as an intervening variable.

Method

The population of this study involved all active students at a private university in Bandung in 2023. From this entire population, 59 students were taken using the Convenience sampling method from various faculties. The form of research from this scientific work is causality research. The primary data source that was collected and processed in this study was obtained from the responses of university students who are actively studying in 2023. These responses were in the form of answers to questions asked about system quality, information quality, and student portal service quality. Primary data were obtained directly from respondents through questionnaires distributed via Google Form. The scale used is a Likert scale with five levels of performance, namely 1-5 measurement. 1 states the response "strongly disagree", while 5 states the response "strongly agree". Questionnaires were distributed to respondents on April 12, 2023 and closed on May 12, 2023. The data processing method used in this study is a statistical method using the *SmartPLS* 3.0 program. Evaluation of the measurement model (outer model) consisted of a validity test and a reliability test. Meanwhile, evaluation of the structural model (inner model) consisted of R-Square, goodness of fit test and hypothesis testing (Semiawan, 2017; Sugiyono, 2019).

Results and Discussions

Descriptive analysis was used to describe the respondents from the data collected. The results of the descriptive analysis explain the circumstances or conditions of the respondents which can be considered as one of the information when understanding the research results.

Table 1. Characteristics of Respondents

Characteristics of Respondents	Frequency	Percentage
Major		
Accountancy	29	49.2%
Management	10	16.9%
Economic Development		
Law Science	6	10.2%
Mathematics	3	5.1%
Physics		
International Relations	1	1.7%
Business Administration	2	3.4%
Public Administration		
Civil Engineering	3	5.1%
Chemical Engineering		
Industrial Engineering	1	1.7%
Electrical Engineering	1	1.7%
Informatics Engineering	1	1.7%
Architecture	2	3.4%
D3 Company Management		
Philosophy		
Batch		
2017	1	1.7%
2018	4	6.8%
2019	4	6.8%
2020	42	71.2%
2021	6	10.2%
2022	2	3.4%

Evaluation of the Measurement Model (Outer Model)

Testing of the measurement model will be carried out to show the results of the validity and reliability tests. The validity test was carried out with the aim of determining whether all constructs met the requirements to continue as research or not.

a. Convergent Validity Test

Table 2. Validity Test Results

Variable	Items	Loading Value	Conclusion
System	KS1	0,916	**Valid**
Quality	KS3	0,896	**Valid**
Information	KI1	0,784	**Valid**
Quality	KI4	0,800	**Valid**
	KI5	0,901	**Valid**
Service	KL2	0,861	**Valid**
Quality	KL3	0,841	**Valid**
	KL4	0,798	**Valid**
User	KP1	0,889	**Valid**
Satisfaction	KP2	0,789	**Valid**
	KP3	0,915	**Valid**
	KP4	0,908	**Valid**
Net Benefit	MB1	0,933	**Valid**
	MB2	0,947	**Valid**

Source: *Outputs* SmartPLS 3 (2023)

The variables tested for validity are System Quality (five indicators), Information Quality (five indicators), and Service Quality (four indicators). Convergent validity is fulfilled if the factor loading value for each indicator is > 0,7. The results of the convergent validity test through factor loading which was carried out for the first time showed that not all indicators were declared valid.

System quality indicators that do not meet the loading factor value are ease of access (KS2), system reliability (KS4), and system security (KS5). The information quality indicators that do not meet the value of the loading factor is the timeliness of information (KI2) and completeness of information (KI3). As for service quality, the indicator that does not meet the loading factor is the portal design (KL1).

Based on the results of the re-estimation of the loading factor, the values generated by the constructs of system quality, information quality, service quality, user satisfaction, and net benefits have met the standard values of convergent validity because all factors have a value more than 0,7. Thus, it can be concluded that all constructs are valid.

b. Reliability Test

Besides testing the validity, the researcher also conducted reliability tests. In order to determine the reliability of each construct, a test was carried out by looking at the Cronbach 's Alpha value of each construct. If the Cronbach's alpha coefficient > 0,7, then it can be declared reliable. Conversely, if the Cronbach's alpha coefficient < 0,7, then it can be declared unreliable. Besides using Cronbach's alpha, the reliability test can use composite reliability whose value is > 0,7 to be said as reliable.

Table 3. Reliability Test Results

Variable	Cronbach's Alpha	Composite Reliability	Conclusion
System Quality *(KS)*	0,783	0,869	Reliable
Information Quality *(IC)*	0,774	0,872	Reliable
Quality of Service *(KL)*	0,782	0,930	Reliable
User Satisfaction *(KP)*	0,898	0,902	Reliable
Net Benefits *(MB)*	0,869	0,939	Reliable

Source: Outputs SmartPLS 3 (2023)

The results of the reliability test in the table above show that all research variables can be said to be reliable because the *Cronbach's alpha value* is > 0,7. Besides the Cronbach's alpha value, the composite reliability value also shows a number greater than 0,7. Thus, it can be concluded that all variables can be used as instruments in measuring the variables specified in this study. The following are the results of the outer model test after re-estimation.

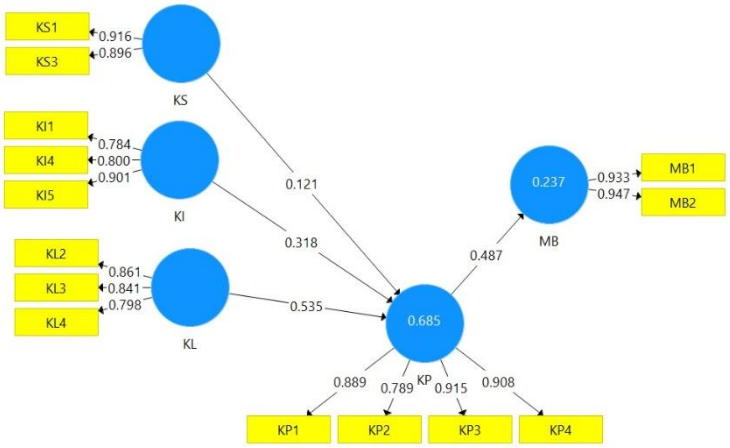

Figure 1. Outer model test results after re-estimation

Evaluation of the Measurement Model (Inner Model)

Structural model aims to predict the correlation between latent variables based on the substantive theory of the structural model evaluated using R-square for the dependent construct.

a. R-*Square* (R^2)

Table 4 *R-Square*

Variable	R-Square	R-Square Adjusted
User Satisfaction (KP)	0,685	0,668
Net Benefits *(MB)*	0,237	0,224

Source: Outputs SmartPLS 3 (2023)

From the results of the R-Square in the table above, it shows that the R-Squares value for the variable user satisfaction is 0,685, meaning that user satisfaction can be explained by system quality, information quality, and service quality of 68.5%. Then, the remaining of 31.5% is explained by other factors not present in this study. The R-Squares value for the net benefit variable is 0,237, meaning that the net benefit variable that can be explained by user satisfaction is 23.7%. The remaining of 76.3% is explained by other factors not present in this study.

Adjusted r-square value is 0,668 which means that system quality, information quality, and service quality together affect user satisfaction by 66.8%. The adjusted r-square value is 0.224, which means system quality, information quality, and service quality together affect the net benefit mediated by user satisfaction by 22.4%.

b. Hypothesis testing

The hypothesis that is stated accepted or rejected can be seen by looking at the significance values between constructs, t-statistics, and p-values. The hypothesis is accepted if the significance value of the t-value is greater than 1,96 or the p-value is less than 0,05.

Table 5. Path Coefficient Test Results

	Original Sample (O)	Sample Means (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
System Quality -> User Satisfaction	0,121	0,126	0,091	1,336	0,182
Information Quality -> User Satisfaction	0,318	0,313	0,085	3,761	0,000
Service Quality -> User Satisfaction	0,535	0,536	0,077	6,977	0,000
User Satisfaction -> Net Benefit	0,487	0,485	0,110	4,441	0,000

Source: Outputs SmartPLS 3 (2023)

The system quality variable on user satisfaction has a t-statistical value of 1,336, which is less than 1,96, and a p- value of 0,182, which is greater than 0,05. Therefore, the first hypothesis which states that system quality affects user satisfaction is not proven or the first hypothesis is rejected.

The variable of information quality on user satisfaction has a t-statistical value of 3,761, which is greater than 1,96. P-values also produce a value of 0,000 which is less than 0,05. Therefore, the second hypothesis which states that the quality of information affects user satisfaction is proven or the second hypothesis is accepted.

The service quality variable on user satisfaction has a t-statistical value of 6,977, which is greater than 1,96. P-values also produce a value of 0,000 which is less than 0,05. Therefore, the third hypothesis, which states that service quality affects user satisfaction, is proven or the third hypothesis is accepted.

The user satisfaction variable for net benefits has a t-statistical value of 4,441 which is greater than 1,96. P-values also produce a value of 0,000 which is less than 0,05. Therefore, the fourth hypothesis, which states that user satisfaction, has an effect on proven net benefits or the fourth hypothesis is accepted.

c. Goodness-of-Fit (GoF) test

GoF test is obtained by multiplying the average variance extracted (AVE) root value presented in Table 6 with the average r-square root in Table 4.

Table 6. Community Index Value

Variable	Average Variance Extracted (AVE)	Communality Index Value
System Quality	0,821	
Information Quality	0,689	
Service Quality	0,695	
User Satisfaction	0,769	
Net Benefit	0,884	
Average of Communality Index		0,772

Source: Outputs SmartPLS 3 (2023)

With the GoF calculation as follows:

GoF = $\sqrt{Com} \times \sqrt{R2}$

= $\sqrt{0.772} \times \sqrt{0.685}$

= 0,726

From the results of the calculation above, a GoF value of 0,726 is obtained. Thus, it can be concluded that the model in this study has a large goodness of fit because the value is above 0,36. The greater the GoF value, the model in this study is more suitable or in accordance with the research data.

Discussion of Research Results

This research was conducted with the aim to determine the influence of system quality, information quality, and service quality variables on net benefits mediated by academic information system user satisfaction. The results of hypothesis testing can be seen in the following table:

Table 7 Hypothesis Testing Results

	Hypothesis	Original Sample	T-Statistics	P-values	Information
H1	System quality affects user satisfaction	0,121	1,336	0,182	Rejected
H2	Information quality affects user satisfaction	0,318	3,761	0,00019	Accepted
H3	Service quality affects user satisfaction	0,535	6,977	0,000	Accepted
H4	User satisfaction affects the net benefits	0,487	4,441	0,000011	Accepted

a. The Influence of System Quality on User Satisfaction of Academic Information System

Based on the hypothesis testing that has been carried out, the t-statistical value for this correlation is 1,336, which is less than 1,96 and the *p-value* is 0,182 which is greater than 0,05. These results conclude that the system quality variable has no influence and is not significant on user satisfaction.

Based on the results of the questionnaire obtained, the average of each answer for each indicator of the system quality variable ranges from 2,9 to 4,4. The dimension of user convenience shows that the average number of respondents' answers is 4,1, which means that respondents agree that the display of the student portal is user-friendly and the login process to the system is easy. The dimension of ease of access shows that the average number of respondents' answers is 4,4, which means that respondents agree that the student portal is easily accessible anywhere and can be accessed using a mobile phone.

The access speed dimension shows the average number of respondents' answers at 3.4 or neutral. The speed of access to the student portal during certain hours requires a longer time. This figure shows results that are not too bad but the quality needs to be improved. The dimension of system reliability shows an average number of 2,9. Respondents did not agree that the student portal has a fast data backup and error recovery process. The system security dimension shows the number of 3,5 or neutral. There are still respondents who feel that user confidentiality is not maintained.

The quality of the system contained in the student portal of a private university in Bandung has not provided satisfaction to users of the system, namely students. Respondents feel that there are still obstacles in the system. The most felt obstacle is the reliability of the system. At certain times, especially when filling in the FRS (Study Plan Form), an error often occurs. Respondents feel that the error recovery process takes quite a long time so that students do not get the desired course. Respondents also felt that it took longer if students would access the student portal at certain hours to make attendance.

The results of this study are in line with research conducted by Panjaitan et al. (2019), which states that system quality has no influence and is not significant on user satisfaction. The *p-value* in this study shows the number of 0,784, which is greater than 0,05. The results of this study showed that 14% of respondents had problems using the system and 12% of respondents felt that the system was not always available when used.

b. The Influence of Information Quality on User Satisfaction of Academic Information System

Based on the hypothesis testing that has been carried out, the t-statistic value for this correlation is 3,761, which is greater than 1,96 and the *p-value* is 0.000, which is less than 0,05. Thus, the quality of information has a significant influence on user satisfaction of academic information systems, which can be seen from the results of the original sample with a positive value (O=0,318). This means that the quality of information and user satisfaction has a unidirectional correlation. When the quality of information has increased, user satisfaction will also increase.

Based on the results of the questionnaires obtained, the average of each answer for each indicator of the information quality variable ranges from 3,8 to 4,3. This means that respondents agree that the information provided on the student portal is beneficial for the continuity of learning and students are satisfied, and it shows the good result. There are several characteristics used to assess the quality of information. The characteristics used in this study are the accuracy of the information, the timeliness of broadcast, the completeness of the information, the presentation of the information, and the relevance of the information.

The average respondent gave a score of 4,3 on the accuracy of the information. Students agree that the information provided on the student portal is accurate. The information provided is usually about replacement classes, job vacancies, academic calendars, and the amount that needs to be paid in one semester. Respondents also agreed by giving a number of 4 for the completeness of the information provided, the presentation of information that is easy for students to read and understand using a good format, and the information presented is useful. Timeliness when displaying information is also quite good as evidenced by the average respondent's answer of 3,8. However, it needs to be improved again so that they are not left behind with important information related to lectures.

The results of this study are in line with research conducted by Ishak et al. (2022), which states that the quality of information has a significant influence on user satisfaction of thesis information system and practical work (SISKP). Another study conducted by Hami & Anggraini (2022) also stated that the quality of information has a significant influence on user satisfaction.

c. The Influence of Service Quality on Academic Information System User Satisfaction

Based on the hypothesis testing, the t-statistic value for this relationship is 6,977, which is greater than 1,96 and the *p-value* is 0.000, which is less than 0,05. This means that service quality has a significant and significant influence on academic information system user satisfaction. The original sample value in the table of path coefficient test results shows the number 0,535, which describes a unidirectional correlation. The higher the quality of services provided, the higher the student portal user satisfaction.

The quality of service discusses about the visual student portal as well as the administrative officers who manage the student portal and those who often provide information related to learning. The indicators used in this study are e-service quality (e-servqual), namely the student portal design is attractive and the text font used is easy to read. Apart from talking about visuals, e-servqual measures the patience and friendliness of the administration, whether the administration can maintain the

confidentiality of personal information and does not access or change data arbitrarily, as well as the administration that solves problems appropriately and quickly.

Based on the results of the questionnaires obtained, the average of each answer for each indicator of the service quality variable ranges from 3,5 to 4,1. Respondents agree by providing a score of 4,1 for the student portal which is visually attractive and the text font is easy to read. The average respondent's answers gave a score of 3,6 for the patience and friendliness of the officers, namely administration when providing services and answering questions. Respondents also gave a score of 3,7, which means that administration is good enough in maintaining the confidentiality of data or personal information and they agree that administration does not access and change personal data on the student portal. Apart from that, administration is quite good at solving problems accurately and quickly as evidenced by the results of the average number of respondents' answers of 3,5.

The results of this study reinforce previous research, namely research conducted by Novianto (2020) which found that service quality has a significant influence on user satisfaction. The *p-value* in this study shows the number 0,036, which is smaller than 0,05.

d. The Influence of User Satisfaction on the Net Benefits of Academic Information Systems

Based on the hypothesis testing, the t-statistic value for this correlation is 4,441, greater than 1,96 and the p-value is 0,000, less than 0,05. This means that user satisfaction has a significant and significant influence on the net benefits of academic information systems. The original sample value in the table of path coefficient test results shows the number 0,487, which describes a unidirectional correlation. The higher the user satisfaction, the higher the net benefits of using an academic information system.

Users who are satisfied with system quality, information quality, and service quality from the student portal will also experience net benefits from using the system. Based on the results of the questionnaire obtained, the average of each answer for each indicator of the information quality variables ranges from 3,8 to 4. Overall, users are satisfied with the current student portal and give a number of 4, which means they agree. For services provided as a whole, the average respondent gave a score of 3,8. For software, the average respondent gives a score of 3,9 which indicates good results. In addition, the student portal has also sufficiently met user expectations so that respondents gave a score of 3,8.

The net benefits obtained by users, such as the student portal make it easy to view courses, make attendance, and make it easy to see the grades of all courses. In addition, the student portal also makes it easy to find out the number of absences and manage lecture payments so that respondents give a score of 4,4 for both individual impact and organizational impact.

The results of this study strengthen previous research conducted by Meilani et al. (2020). The results of this study indicate that user satisfaction has a positive and significant influence on net benefits with a beta coefficient of 0,486 and a t-statistic of 10,503. Another study conducted by Putra et al. (2022) showed that the results of user satisfaction have a significant infuence on the net profit of the STIKes Sukabumi academic information system.

e. The Influence of System Quality, Information Quality, and Service Quality on Net Benefit with User Satisfaction as Mediation Variable

Table 4 shows the adjusted r-square numbers of 0,668 and 0,224. This means that system quality, information quality, and service quality affect user satisfaction by 66,8%. Because the adjusted r-square is more than 33% but less than 67%. The effect of system quality, information quality, and service quality on user satisfaction is moderate. The adjusted r-square value is 0,224, which means system quality, information quality, and service quality affect the net benefits mediated by user satisfaction by 22,4%. Adjusted r-square is less than 33%, so the effect of system quality, information quality, and service quality on net benefits mediated by user satisfaction is weak.

Conclusions

The quality of the system as measured by ease of use, ease of access, speed of access, system reliability, and system security cannot be proven statistically to have a statistical effect on user satisfaction of academic information systems at a private university in Bandung. The quality of the existing system has not given satisfaction to students. Information quality as measured by information accuracy, information timeliness, information completeness, information presentation, and information relevance affect user satisfaction of academic information systems. The quality of the information provided on the student portal is good in helping students with learning so that students feel satisfied. Service quality as measured by portal design, customer service, security and privacy, and fulfillment has an effect on academic information system user satisfaction. Officers, namely administration, have provided good services, such as patience and friendliness of officers in answering questions and maintaining the confidentiality of student personal information. User satisfaction affects the net benefits. Moreover, users who are satisfied with the system quality, information quality, and service quality of the academic information system will also experience net benefits from using the system. System quality, information quality, and service quality have a weak effect of 22,4% (<33%) on net benefits mediated by user satisfaction of academic information system. Future researchers should examine this research topic and should add other independent variables that may affect user satisfaction and the net benefits of academic information systems, such as perceived security and privacy. In addition, future researchers can increase the number of samples studied by looking for respondents in all faculties so that research results can be more accurate. The limitation of this research is that this research is limited to research on research subjects. Future research can conduct research with a wider population.

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