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The Analysis of Factors Affecting the Successful Implementation of a Forest Management Information System in Forestry Company

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Abstract: The present study offers a comprehensive review of the determinants of the success of an Indonesian forestry company's implementation of the Forest Management Information System (FMIS). By integrating variables from multiple prior works into an updated version of the DeLone and McLean model, this study investigates six key variables: System Quality, Net Benefits, User Satisfaction, Information Quality, Information Use, and User Quality. Enhancing the efficiency of FMIS deployment and minimizing potential failures in subsequent implementations are the principal objectives. In order to acquire data, a questionnaire that had been carefully crafted was utilized, guaranteeing that responses would be representative and dependable. The refined DeLone and McLean model played a pivotal role in identifying critical determinants that underpin the achievement of information systems objectives. The results unequivocally demonstrate the efficacy of the FMIS deployment at the forestry company in Indonesia, with User Satisfaction emerging as the most critical determinant with a mean score of 0.859. Information Quality, User Quality, Information Use, and System Quality follow in close succession. The study substantiates the substantial and favorable influence of these variables on user contentment and the overall net advantages, providing valuable perspectives on the effective execution of information systems, specifically within the framework of FMIS.

Keywords: *DeLone and McLean Model, Success Factor Analysis, Forest Management, Forest Management Information System*

1. Introduction

The forestry industry in Indonesia plays a vital role in the nation's economy through its wood products and contributes significantly to the environmental, social, and ecological well-being, which essential for sustainable development [1]. The Indonesian government has boosted economic growth through the Industrial Forest Plantation (IFP) concessions, enhancing export performance, employment, investment value, and state revenue from taxes [2]. The forest products demand, particularly wood, is projected to escalate up to 6 billion m³ by 2050, driving IFP expansion [3]. The wood industry, primarily sourced from IFP, encompasses a diverse range of sectors. These include pulp, chip wood, sawn wood, plywood, energy, pellets, and rubber as primary sector, paper, and woodworking as secondary sector, while furniture represents the tertiary sector. According to the 2019-2045 Production Forest Development Road Map by the Indonesian Forestry Association (APHI), the target for 2045 is to achieve a raw wood supply of 269.05 million m³ per year, yielding 180.65 million m³ of wood industry products [4]. However, the industry faces challenges like unpredictable business conditions, poor competitiveness in wood processing, low land productivity, land disputes, and high production costs. If these issues remain unaddressed, they could pose a significant threat to the future of wood supply, which could intensify environmental harm, such as deforestation, lead to the degradation of forests, and undermine the international market's trust in Indonesian wood products [5].

Precise and accurate forestry data is crucial in addressing the Indonesian forestry industry's challenges, as evidence-based policymaking depends on the availability of data obtained through information systems and ICT, especially spatial data [6] or sensorics data [7]. Implementing these systems and technologies is vital for achieving sustainable economic and ecological development in forestry, allowing for more precise forest management and decision-making processes [8]. Asia Pulp & Paper (APP) Sinarmas, a prominent member of the Sinarmas Group that dominates the pulp and paper industries in Indonesia, has invested in and developed the Forest Management Information System (FMIS) using Geographic Information System (GIS) technology to enhance forest monitoring and protection [9]. The successful implementation of FMIS, crucial for supporting business operations, integrates forestry operations and provides spatial data needs internally and publicly. Similar advancements in technology have also been seen in other sectors, such as in mechanical [10] and fishery sector [11].

As a relatively new implementation, the success of FMIS has not yet been analysed from the users' perspective, and currently, there are no reports to illustrate whether FMIS has met its user's needs. However, we who are also part of the FMIS development and management team have received

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user complaints via email, including issues like occasional procedural and validation failures, slow response/loading times during report generation and data entry, and queries about how to use the application. Therefore, understanding the successful factors that contribute to the implementation of an information system within an organization is crucial for ensuring that the system supports the organization's vision and mission [12].

To determine the factor that can impact the successful execution of a project, a robust method or model is required. One such model that is suitable for identifying these factors is the DeLone & McLean model, which has the capability to measure the successfulness of information systems in a way that can represent the needs of stakeholders [13], [14]. This model was further improved in 2012 by Urbach and Müller, emphasizing various dimensions such as System Quality, Net Benefits, User Satisfaction, Information Quality, Information Use, and Service Quality. The aim was to provide a comprehensive definition of the success of information systems, encompassing various evaluation viewpoints [15]. The Urbach updated model was then further refined by Eldrandaly et al. for a specific use-case, which is to measure the key factor on success of a GIS-based information system. The improved model provided by Eldrandaly et al. includes System Quality, User Satisfaction, User Quality, Information Quality, Information Use, Net Benefits to Society, Net Benefits to Organization, and Net Benefits to Individuals dimensions [16]. These dimensions of the model suggest that the quality of information has a causal relationship with both user quality and system quality. User quality is more about the user's knowledge and understanding related to the dashboard and reading maps, while information quality has a relationship to influence the use of information and create user satisfaction.

Inspired by previous works, this study focuses on analysing the factors that influence successful implementation of the Forest Management Information System at Asia Pulp & Paper (APP) Sinarmas. We adopted the updated Delone and McLean model, which incorporates variables from Eldrandaly, Naguib, and Hassan (2015) and Urbach and Müller (2012), focusing on System Quality, Net Benefits, User Satisfaction, Information Quality, Information Use, and User Quality on our works. By identifying these critical factors, we aim to enhance the existing FMIS implementation and mitigate potential failures in future deployments.

2. Literature Review

The research on identifying the success factor of information systems implementation has evolved significantly over the years, with a focus on various models and industries. A noteworthy progression in this field can be observed through a series of studies that have adopted and modified the DeLone and McLean model, a prominent framework in evaluating the success of information systems. In 2016, Zhang et al. conducted a literature study to explore methods for measuring the effectiveness of IT. They considered various models, including the DeLone and McLean 2003 model, highlighting its continued relevance in the field. Their research encompassed a broad range of industries and provided a comprehensive view of IT effectiveness measurement techniques [17].

In the same year, Kartika et al. focused on the impact of information quality and system quality on perceived usefulness and user satisfaction across various industries. Their findings emphasized the direct correlation between timely, relevant information and user satisfaction, reinforcing the critical role of perceived usefulness in enhancing user satisfaction, particularly in the context of accounting software usage [18]. The following year, 2016, witnessed a study by Sirsat and Sirsat in the education sector. They utilized the DeLone and McLean 2003 model to study the significant impact of information and system quality on performance and user satisfaction. However, they also noted that system quality and system usage did not significantly impact user performance, providing a nuanced understanding of these relationships [19].

Jaya and Fajar, in 2019, extended the implementation of the DeLone and McLean model to public services. Their research, which employed quantitative analysis using SEM PLS, shows the positive impact of information and system quality on performance and user satisfaction. However, they interestingly observed that system quality and system usage did not significantly affect user performance, contributing to a more complex understanding of these variables in the public service context [20]. Still in the same year, Vongurai examined the factors influencing the net benefits of adopting Google Drive among Thai users. Employing the DeLone and McLean Method, his study revealed positive effects of service, system, and information quality on usage intensity and user satisfaction, which in turn impacted net benefits [21].

Most recently, in 2023, Kurniawan and Tjhin applied an updated and customized version of the DeLone and McLean model to the telecommunications industry. Their research found significant influences of user satisfaction and information use on individual net benefits. They also reported high success levels across six variables: System Quality, Net Benefits to Individuals, User Satisfaction, Information Quality, Information Use, and User Quality [22]. These studies collectively demonstrate a consistent and evolving interest in understanding the success factors of information systems across various industries, using the DeLone and McLean model as a foundational framework. Each study contributes unique insights and adaptations, reflecting the dynamic nature of information systems research.

3. Method

3.1. Research Stages

In the pursuit of identifying the key factors that can affect the success of FMIS project deployment, a systematic research process is employed. This process, as illustrated in Fig. 1, provides a structured approach to the investigation. Each stage of the process, from problem identification to conclusion, is crucial in guaranteeing the accuracy and consistency of the results.

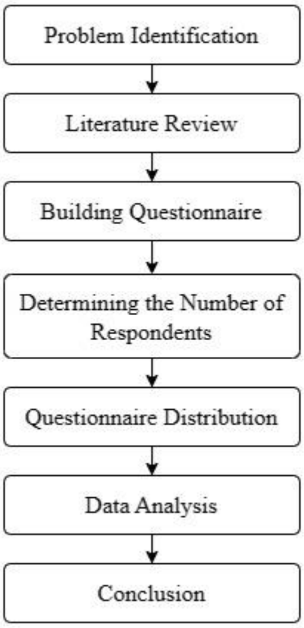

Fig. 1. Research stages.

As depicted in Fig. 1., the research process starts with the identification of a problem, which is analyzed thoroughly to understand its nature and scope. After identifying the problem, a literature review is conducted to study existing related works, gather insights, and identify gaps that need addressing. The next stage involves the preparation of a questionnaire, created to collect specific data related to the research objectives. The next step is to determine an appropriate number of respondents, ensuring that the collected data is representative and reliable. Once the number of respondents is determined, the questionnaire is distributed for data collection. The responses are then gathered, and a comprehensive data analysis is conducted. This stage involves interpreting the results, which provide insights into the research problem. The final stage of the research process involves drawing conclusions based on the findings and making recommendations for future studies or practical implementations. This stage provides closure to the current research and sets the direction for future research.

3.2. Research Model

This research utilizes a model based on the work of DeLone and McLean, with the objective of identifying the key factors that contribute to the success of an information system. Based on an extensive literature review, we have modified the model into our case, resulting in a model that includes specific variables critical to the successful implementation of FMIS. The model incorporates findings from the studies of Eldrandaly et al. (2015), as well as Urbach and Müller (2012). Our modified DeLone and McLean model comprises of System Quality (SQ), Net Benefits (NB), User Satisfaction (US), Information Quality (IQ), Information Use (IU), and User Quality (UQ) variables. Fig. 2. illustrates the conceptual model employed in our study.

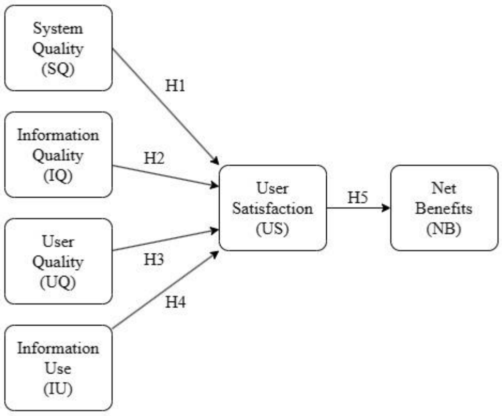

Fig. 2. Research model.

3.3. Research Variables

The six variables stated previously cannot be used directly because it is too general, each of them needs an indicator. These indicators will be used to calculate the score of the variables. Table 1 reveals the details of variables and its indicator used in this research.

Table 1. Variable and indicator.

Variables	***Indicators***
System Quality (SQ) [16]	User friendless (SQ1)
	Response time (SQ2)
	Database content (SQ3)
	Functionality (SQ4)
	Reliability (SQ5)
User Quality (UQ) [16]	Comfort to use (UQ1)
	Capable to do (UQ2)
	Understand what to do (UQ3)
	Confidence to use (UQ4)
	Spatial ability test (UQ5)
Information Quality (IQ) [16]	Accuracy (IQ1)
	Completeness (IQ2)
	Easy of interpretation (IQ3)
	Reliable (IQ4)
	Relevancy (IQ5)
	Format (IQ6)
	Clarity (IQ7)
	Daily Use (IU1)

Information Use (IU) [15]	Frequency of use (IU2) Intention to (re)use (IU3) Nature of use (IU4) Navigation patterns (IU5)
User Satisfaction (US) [15]	Pleased with the information (US1) Effectiveness (US2) Efficiency (US3) Enjoyment (US4) Information satisfaction (US5) Overall satisfaction (US6)
Net Benefits (NB) [15]	Job effectiveness (NB1) Job performance (NB2) Time saving (NB3) Productivity (NB4) Learning (NB5) Usefulness (NB6) Task innovation (NB7) Enhanced Decision Making (NB8)

The six variables listed in Table 1 are divided into two categories: independent variables and dependent variables. The independent variable is the variable that is not affected by the previous variable, and the dependent variable is the variable that is affected by the previous variable [23]. In this study, there are 5 independent variables and 1 dependent variable. The independent variables are system quality (SQ), user satisfaction (US), information quality (IQ), information use (IU), and user quality (UQ). The dependent variable is net benefits (NB), which is affected by the previous five variables.

3.4. Research Hypothesis

Based on the research model developed, the hypotheses in this study are as follows:

H1: System Quality (SQ) has a significant positive effect on User Satisfaction (US).

H2: Information Quality (IQ) has a significant positive effect on User Satisfaction (US).

H3: User Quality (UQ) has a significant positive effect on User Satisfaction (US).

H4: Information Use (IU) has a significant positive effect on User Satisfaction (US).

H5: User Satisfaction (US) has a significant positive effect on Net Benefit (NB).

3.5. Population and Sample

The population of this study includes all regular and active users of FMIS within the IFP operating area. These users are distributed in five provinces: East Kalimantan, West Kalimantan, South Sumatra, Jambi and Riau, with a total population of 700 people. One technique that can be used to calculate sample size is the Slovin method [24]. If the selected sample is not representative, it is difficult to draw accurate conclusions that apply to the entire population. The Slovin formula is shown in (1).

$$n = \frac{N}{1+Ne^2} \quad (1)$$

Where:

n = sample size

N = population size

e = error tolerance

Therefore, based on the above formula, the required sample size from a population of 700 people with a 5% error rate is shown in (2).

$$n = \frac{700}{1+700\times(0.05)^2} = 254.5455 \ \approx \mathbf{255\ Peoples} \quad (2)$$

3.6. Research Instrument

Each indicator is assessed utilizing a Likert scale in this research. The previously mentioned scale is utilized to evaluate the perspectives, attitudes, and perceptions of a collective or an individual with respect to societal phenomena. The evaluation of each item's response in the instrument is conducted using a 5-point Likert scale. The scale ranges from 1 (Strongly Disagree) to 5 (Strongly Agree), with No Objection (SD) and Strongly Agree (SA) serving as the extremes. The notation employed for the Likert scale in this research is presented in Table 2.

Table 2. Likert scale notation.

Variable	***Score***
Strongly Disagree (SD)	1
Disagree (D)	2
Neutral (N)	3
Agree (A)	4
Strongly Agree (SA)	5

3.7. Data Collection

The method used to collect data this research is a survey though a questionnaire consisting of a set of questions about the measured variables. The questionnaire was distributed to a forestry company, which is spread across five provinces: East Kalimantan, West Kalimantan, South Sumatra, Jambi and Riau. This questionnaire is divided into two parts, namely part A and part B, which conducted in Bahasa Indonesia. Part A contains respondent data such as employee identification numbers, respondent names, and department origins. Part B contains 36 questions regarding the variables and the indicators. The English translated questions or statements of the questionnaire are presented in Table 3.

Table 3. English translated questionnaire.

No	***Statement***
SQ1	I can use the FMIS Portal easily
SQ2	I can access information on the FMIS Portal quickly
SQ3	I got accurate information from the FMIS Portal
SQ4	I got a variety of information from the menus available on the FMIS Portal
SQ5	The FMIS Portal can be relied upon to support my daily work
UQ1	I feel comfortable using the FMIS Portal
UQ2	I can use the menus in the FMIS Portal well
UQ3	I understand the steps in using the FMIS Portal
UQ4	I have confidence that I can use the FMIS Portal well
UQ5	I understand the geographical scale in reading information from the FMIS Portal
IQ1	I got accurate information while using the FMIS Portal
IQ2	I got complete information according to work needs from the FMIS Portal
IQ3	Information generated from the FMIS Portal is easy to understand
IQ4	The information in the FMIS Portal useful for supporting my work
IQ5	The information from the FMIS Portal suitable for my work needs
IQ6	Information presented on the FMIS Portal has been visualized well
IQ7	I got precise data from the FMIS Portal
IU1	I use the FMIS Portal every day to assist my work
IU2	My frequency of using the FMIS Portal is Very Often, Often, enough, Rare, Very Rare
IU3	I often use the menus in the FMIS Portal related to my work
IU4	I need the Portal to do my job
IU5	I find it easy to use the FMIS Portal because it is equipped with a user guide
US1	I am satisfied using the FMIS Portal
US2	My work becomes more effective by using the FMIS Portal
US3	FMIS portal save my time
US4	I feel comfortable using the FMIS Portal
US5	I am satisfied with the data and information displayed on the FMIS Portal
US6	Overall, I am satisfied with the FMIS Portal
NB1	I feel helped doing my work by using the FMIS Portal
NB2	I feel my performance improves by using the FMIS Portal
NB3	I feel able to work faster by using the FMIS Portal
NB4	I feel my work productivity increases by using the FMIS Portal
NB5	I learn a lot from the data and information on the FMIS Portal
NB6	I feel the usefulness of the FMIS Portal
NB7	I get ideas to innovate after using the FMIS Portal
NB8	I feel helped to make decisions in my work after using the FMIS Portal

3.8. Validity and Reliability Test

Prior to distributing the questionnaire to the participants, it’s essential to perform validity and reliability tests on it. The purpose of the validity test is to verify if all the questions or statements in the proposed research instrument that are intended to measure the research variables are valid [23]. A questionnaire is deemed valid if its questions or statements can accurately measure what they’re intended to measure. On the other hand, the reliability test is utilized to ascertain the consistency level of the instrument or questionnaire being measured [25]. A questionnaire is considered reliable if it yields the same data when used multiple times to measure the same object. The questionnaire’s validity and reliability tests are conducted using SmartPLS.

The validity assessment is conducted by utilizing the Loading Factor outcome and the Average Variance Extracted (AVE) value. Veracity can be inferred regarding the variables and indicators utilized if the AVE value of each variable exceeds 0.5 and the Loading Factor result of each indicator surpasses 0.7 [26]. The assessment of the questionnaire items' consistency is conducted through the utilization of Cronbach's Alpha and Composite Reliability metrics in the reliability test. The reliability of the queries formulated can be deduced if the Cronbach's Alpha and Composite Reliability values for each variable surpass 0.7, as stated by Hair et al. (2020) [26].

3.9. Data Analysis

The stage of data analysis was carried out once the data from all participants were gathered. Generally, the tasks in data analysis involve categorizing data according to variables and respondent types, tabulating data based on variables from all participants, displaying data from each variable, conducting computations to address the problem statement, and executing calculations to test the suggested hypotheses.

The analysis model used in this study is multiple linear regression analysis, which aims to measure the magnitude of the influence of independent variables on the dependent variable.

$$NB = \beta_{10} + \beta_{11}\, US + \varepsilon_1 \qquad (3)$$

$$US = \beta_{20} + \beta_{21}\, SQ + \beta_{22}\, IQ + \beta_{23}\, UQ + \beta_{24}\, IU + \varepsilon_2 \qquad (4)$$

Where:

NB = Net Benefits as the dependent variable

SQ = System Quality as an independent variable

IQ = Information Quality as an independent variable

UQ = User Quality as an independent variable

IU = Information Use as an independent variable

US = User Satisfaction as an independent variable

From the above linear regression shown in (3) and (4), the following hypotheses can be written:

H_5: User satisfaction has a positive effect on net benefits.

H_0: $\beta_{11} = 0$

H_a: $\beta_{11} \neq 0$

H_1: System quality has a positive effect on user satisfaction.

H_0: $\beta_{21} = 0$

H_a: $\beta_{21} \neq 0$

H_2: Information quality has a positive effect on user satisfaction.

H_0: $\beta_{22} = 0$

H_a: $\beta_{22} \neq 0$

H_3: User quality has a positive effect on user satisfaction.

H_0: $\beta_{23} = 0$

H_a: $\beta_{23} \neq 0$

H4:

Information use has a positive effect on user satisfaction.

H_0: $\beta_{24} = 0$

H_a: $\beta_{24} \neq 0$

To decide whether to reject or accept H_0, the P-value is used, if a P-value ≤ 0.05, H0 will be rejected (or H_a accepted) and vice versa. The processing and analysis of the data are done using SmartPLS software. This method ensures a robust and reliable analysis of the data, providing valuable insights for the research.

4. Results and Discussions

The questionnaire was distributed via Microsoft Form to 700 active FMIS respondents at forestry companies in five provinces. East Kalimantan, Riau, Jambi, South Sumatera, and West Kalimantan are the provinces. In accordance with the minimum sample calculation, 304 respondents were collected as valid samples.

4.1. Descriptive Statistical Analysis of Research Variables

Utilizing descriptive statistical analysis of the research variables, the tendency of respondents' responses to the questionnaire statements pertaining to the research model was determined. This elucidates the behavior and distribution of the sampled data in general. The findings are displayed in the following table format.

Table 4. System Quality Descriptive Analysis.

Indicator	***Answer***					***Average***
	5	***4***	***3***	***2***	***1***	
	SA	***A***	***N***	***D***	***SD***	
SQ1	152 50.0%	138 45.4%	14 4.6%	0 0.0%	0 0.0%	4.5
SQ2	118 38.8%	149 49.0%	35 11.5%	2 0.7%	0 0.0%	4.3
SQ3	133 43.7%	148 48.7%	23 7.6%	0 0.0%	0 0.0%	4.4
SQ4	148 48.7%	134 44.1%	21 6.9%	1 0.3%	0 0.0%	4.4
SQ5	158 52.0%	126 41.4%	20 6.6%	0 0.0%	0 0.0%	4.5

Table 4 shows that the respondents' answers to the statements from the System Quality variable obtained an absolute average value of 4.4. From the descriptive statistical results of the System Quality variable, it can be concluded that most respondents believe that the FMIS Portal used can be relied upon to support daily work, is easy to use, can be accessed quickly, can provide accurate information, and can provide the necessary information.

Table 5. User Quality Descriptive Analysis

Indicator	Answer					Average
	5	4	3	2	1	
	SA	*A*	*N*	*D*	*SD*	
UQ1	123 40.5%	146 48.0%	33 10.8%	2 0.7%	0 0.0%	4.3
UQ2	114 37.5%	149 49.0%	38 12.5%	3 1.0%	0 0.0%	4.2
UQ3	145 47.7%	135 44.4%	24 7.9%	0 0.0%	0 0.0%	4.2
UQ4	109 35.9%	146 48.0%	48 15.8%	1 0.3%	0 0.0%	4.4
UQ5	117 38.5%	148 48.7%	37 12.1%	2 0.7%	0 0.0%	4.3

Based on Table 5, the respondents' answers to the statements from the User Quality variable obtained an absolute average value of 4.3. This means that most respondents have good confidence and ability in operating the FMIS Portal and can feel comfortable using the FMIS Portal. In addition, most respondents can read and understand spatial information well on the maps (geographic data) displayed on the FMIS portal.

Table 6. Information Quality Descriptive Analysis.

Indicator	Answer					Average
	5	4	3	2	1	
	SA	*A*	*N*	*D*	*SD*	
IQ1	122 40.2%	160 52.6%	22 7.2%	0 0.0%	0 0.0%	4.3
IQ2	125 41.1%	146 48.0%	33 10.9%	0 0.0%	0 0.0%	4.3
IQ3	119 39.1%	156 51.3%	27 8.9%	2 0.7%	0 0.0%	4.3
IQ4	149 49.0%	134 44.1%	21 6.9%	0 0.0%	0 0.0%	4.4
IQ5	132 43.4%	146 48.0%	26 8.6%	0 0.0%	0 0.0%	4.3
IQ6	113 37.2%	157 51.6%	34 11.2%	0 0.0%	0 0.0%	4.3
IQ7	110 36.2%	172 56.6%	22 7.2%	0 0.0%	0 0.0%	4.3

From Table 6, it can be seen that the respondents' answers to the statements from the Information Quality variable have an absolute average value of 4.3. Overall, it can be concluded that most respondents believe that the quality of tabular and spatial information on the FMIS Portal is easy to understand, precise, accurate, complete, in accordance with needs, well visualized, and can be used to support work.

Table 7. Information Use Descriptive Analysis.

Indicator	Answer					Average
	5	4	3	2	1	
	SA	*A*	*N*	*D*	*SD*	
IU1	116 38.2%	125 41.1%	58 19.1%	5 1.6%	0 0.0%	4.2
IU2	97 31.8%	133 43.8%	72 23.7%	2 0.7%	0 0.0%	4.1
IU3	126 41.4%	131 43.1%	44 14.5%	3 1.0%	0 0.0%	4.3
IU4	153 50.3%	120 39.5%	29 9.5%	2 0.7%	0 0.0%	4.4
IU5	93 30.7%	146 48.0%	60 19.7%	4 1.3%	1 0.3%	4.1

The absolute mean value of the responses provided by the participants regarding the statements comprising the Information Use variable is 4.2, as shown in Table 7. Based on the information in the table, it can be deduced that the majority of respondents utilize the FMIS Portal on a daily basis or with regularity for work-related purposes. In addition, most respondents need the FMIS Portal to assist their work and feel the ease of using the FMIS Portal because it is equipped with technical guidelines.

Table 8. User Satisfaction Descriptive Analysis.

Indicator	Answer					Average
	5	4	3	2	1	
	SA	*A*	*N*	*D*	*SD*	
US1	122 40.2%	157 51.6%	25 8.2%	0 0.0%	0 0.0%	4.3
US2	138 45.4%	136 44.7%	30 9.9%	0 0.0%	0 0.0%	4.4
US3	130 42.8%	134 44.1%	40 13.1%	0 0.0%	0 0.0%	4.3
US4	127 41.8%	143 47.0%	34 11.2%	0 0.0%	0 0.0%	4.3

US5	116 38.1%	161 53.0%	26 8.6%	1 0.3%	0 0.0%	4.3
US6	134 44.1%	147 48.3%	23 7.6%	0 0.0%	0 0.0%	4.4

The respondent's answers to the statements from the User Satisfaction variable can be seen in Table 8 with an absolute average value of 4.3. Based on the table, most respondents feel satisfied and comfortable using the FMIS Portal.

Table 9. Net Benefits Descriptive Analysis.

Indicator	*Answer*					*Average*
	5	***4***	***3***	***2***	***1***	
	SA	***A***	***N***	***D***	***SD***	
NB1	134 44.1%	149 49.0%	20 6.6%	1 0.3%	0 0.0%	4.4
NB2	117 38.5%	145 47.7%	42 13.8%	0 0.0%	0 0.0%	4.2
NB3	125 41.2%	146 48.0%	32 10.5%	1 0.3%	0 0.0%	4.3
NB4	120 39.5%	145 47.7%	38 12.5%	1 0.3%	0 0.0%	4.3
NB5	132 43.4%	149 49.0%	23 7.6%	0 0.0%	0 0.0%	4.3
NB6	153 50.4%	139 45.7%	12 3.9%	0 0.0%	0 0.0%	4.5
NB7	88 28.9%	147 48.4%	69 22.7%	0 0.0%	0 0.0%	4.1
NB8	121 39.8%	149 49.0%	33 10.9%	1 0.3%	0 0.0%	4.3

The absolute average value of 4.3 on the Net Benefits variable can be seen in Table 9. This shows that most respondents agree with each indicator in the Net Benefits variable. Overall, it can be concluded that most respondents believe the FMIS Portal can help work get done faster, assist in decision-making, and increase productivity.

4.2. Research Model Analysis

Fig. 3. below represents a research model applied to the SmartPLS software, which then depicts a research model consisting of several latent variables and calculations using the PLS (Partial Least Square) method. There are two SEM (Structural Equation Modeling) models, namely the measurement model (outer model) and the structural model (inner model).

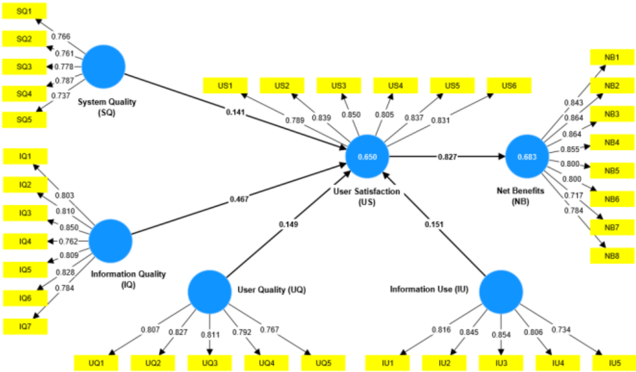

Fig. 3. PLS calculation result.

4.3. Analysis of the Measurement Model (Outer Model)

4.3.1. Test for Convergent Validity

The evaluation of convergent validity is performed by considering the values of the Average Variance Extracted (AVE) and Loading Factor. As stated by Hair et al. (2020), a variable is deemed valid when both the Loading Factor and AVE values exceed 0.7 and 0.5, respectively [26]. Table 10 presented the result of convergent validity, which shows that all variables are valid.

Table 10. Convergent validity test result.

Variable	*Indicator*	*Loading Factor*	*AVE*	*Result*
System Quality (SQ)	User Friendless (SQ1)	0.766	0.587	Valid
	Response Time (SQ2)	0.761		
	Database Content (SQ3)	0.778		
	Functionality (SQ4)	0.787		
	Reliability (SQ5)	0.737		
User Quality (UQ)	Comfort to Use (UQ1)	0.807	0.642	Valid
	Capable to Do (UQ2)	0.827		
	Understand what to Do (UQ3)	0.811		
	Confidence to Use (UQ4)	0.792		
	Spatial ability test (UQ5)	0.767		
Infor-mation Quality (IQ)	Accuracy (IQ1)	0.803	0.651	Valid
	Completeness (IQ2)	0.810		
	Easy of Interpretation (IQ3)	0.850		
	Reliable (IQ4)	0.762		
	Relevancy (IQ5)	0.809		
	Format (IQ6)	0.828		
	Clarity (IQ7)	0.784		
	Daily Use (IU1)	0.816	0.660	Valid

Information Use (IU)	Frequency of Use (IU2)	0.845		
	Intention to (re)use (IU3)	0.854		
	Nature of use (IU4)	0.806		
	Navigation patterns (IU5)	0.734		
User Satisfaction (US)	pleased with the information (US1)	0.789	0.682	Valid
	Effectiveness (US2)	0.839		
	Efficiency (US3)	0.850		
	Enjoyment (US4)	0.805		
	Information satisfaction (US5)	0.837		
	Overall satisfaction (US6)	0.831		
Net Benefits (NB)	Job effectiveness (NB1)	0.843	0.668	Valid
	Job performance (NB2)	0.864		
	Time saving (NB3)	0.864		
	Productivity (NB4)	0.855		
	Learning (NB5)	0.800		
	Usefulness (NB6)	0.800		
	Task innovation (NB7)	0.717		
	Enhanced Decision Making (NB8)	0.784		

4.3.2. Discriminant Validity Test

The assessment of discriminant validity is performed utilizing the Cross Loading technique. The assessment of validity through cross-loading involves examining the correlation between indicators. When an indicator correlates more strongly with the variable it measures, has a Cross Loading value exceeding 0.7, and exhibits a lower correlation with other variables, then the variable is deemed valid [27].

Table 11. Cross loading test result.

Indicator	*IQ*	*IU*	*NB*	*SQ*	*UQ*	*US*	*Result*
IQ1	**0.803**	0.438	0.544	0.596	0.592	0.593	Valid
IQ2	**0.810**	0.527	0.571	0.566	0.603	0.577	Valid
IQ3	**0.850**	0.479	0.563	0.59	0.598	0.631	Valid
IQ4	**0.762**	0.503	0.573	0.556	0.539	0.583	Valid
IQ5	**0.809**	0.515	0.582	0.56	0.562	0.628	Valid
IQ6	**0.828**	0.428	0.557	0.58	0.612	0.652	Valid
IQ7	**0.784**	0.424	0.562	0.568	0.614	0.645	Valid
IU1	0.442	**0.816**	0.535	0.487	0.539	0.481	Valid
IU2	0.391	**0.845**	0.497	0.492	0.516	0.435	Valid
IU3	0.457	**0.854**	0.561	0.535	0.577	0.466	Valid
IU4	0.532	**0.806**	0.569	0.502	0.475	0.54	Valid
IU5	0.522	**0.734**	0.561	0.532	0.625	0.541	Valid
NB1	0.608	0.588	**0.843**	0.589	0.618	0.731	Valid
NB2	0.617	0.617	**0.864**	0.605	0.645	0.721	Valid
NB3	0.603	0.566	**0.864**	0.564	0.619	0.705	Valid
NB4	0.606	0.531	**0.855**	0.536	0.603	0.719	Valid
NB5	0.517	0.546	**0.800**	0.525	0.541	0.638	Valid
NB6	0.594	0.484	**0.800**	0.524	0.522	0.703	Valid
NB7	0.427	0.522	**0.717**	0.487	0.574	0.532	Valid
NB8	0.572	0.572	**0.784**	0.569	0.6	0.625	Valid
SQ1	0.484	0.492	0.502	**0.766**	0.567	0.516	Valid
SQ2	0.495	0.531	0.489	**0.761**	0.607	0.464	Valid
SQ3	0.652	0.43	0.559	**0.778**	0.581	0.585	Valid
SQ4	0.52	0.456	0.495	**0.787**	0.577	0.507	Valid
SQ5	0.554	0.521	0.527	**0.737**	0.561	0.522	Valid
UQ1	0.543	0.599	0.64	0.635	**0.807**	0.574	Valid
UQ2	0.56	0.598	0.574	0.648	**0.827**	0.532	Valid
UQ3	0.524	0.578	0.523	0.573	**0.811**	0.493	Valid
UQ4	0.628	0.497	0.579	0.596	**0.792**	0.585	Valid
UQ5	0.650	0.449	0.562	0.565	**0.767**	0.596	Valid
US1	0.649	0.441	0.601	0.563	0.547	**0.789**	Valid
US2	0.626	0.557	0.729	0.582	0.603	**0.839**	Valid
US3	0.602	0.524	0.72	0.557	0.559	**0.850**	Valid
US4	0.565	0.566	0.69	0.584	0.625	**0.805**	Valid
US5	0.695	0.484	0.697	0.542	0.556	**0.837**	Valid
US6	0.651	0.463	0.65	0.545	0.568	**0.831**	Valid

From the findings presented in Table 11, it's evident that each indicator demonstrates that the correlation of the cross-loading value exceeds 0.7 and attains the maximum value when linked with its latent variable as opposed to when linked with other latent variables. This signifies that each manifest variable in this research has precisely elucidated its latent variable and verifies that the discriminant validity has satisfied the criteria in the test, and all indicators are deemed valid.

The next discriminant validity test is the Fornell-Larcker Criterion. Fornell-Larcker Criterion is a comparison of the root of AVE with the correlation of latent variables. A variable is declared valid if a variable has a correlation value that must be greater than the correlation value between other variables [27].

Table 12. Fornell-Larcker Criterion test result.

Variable	*IQ*	*IU*	*NB*	*SQ*	*UQ*	*US*	*Result*
IQ	**0.807**						Valid
IU	0.585	**0.812**					Valid
NB	0.699	0.676	**0.817**				Valid
SQ	0.711	0.631	0.673	**0.766**			Valid
UQ	0.73	0.677	0.721	0.754	**0.801**		Valid
US	0.764	0.614	0.827	0.681	0.698	**0.826**	Valid

Table 12 demonstrates that the average variance extracted (AVE) root exceeds the correlation value across variables, indicating a theoretical and empirical difference between the variables.

According to a study conducted by Joe F Hair et al. (2022), they suggest using the heterotrait-monotrait ratio of correlations (HTMT) approach instead of the Cross Loading and Fornell-Larcker criterion methods [27]. This is because the HTMT method is more accurate. HTMT refers to the average relationships between distinct constructs compared to the average relationships within the same construct. A variable is considered legitimate if the HTMT for each pair of variables is less than 0.90.

Table 13. HTMT test result.

Variable	*IQ*	*IU*	*NB*	*SQ*	*UQ*	*US*	*Result*
IQ							
IU	0.651						Valid
NB	0.757	0.749					Valid
SQ	0.815	0.745	0.767				Valid
UQ	0.819	0.781	0.806	0.895			Valid
US	0.84	0.682	0.896	0.783	0.786		Valid

According to Table 13, all parameter values match this condition, indicating that all variables can be used in this research model.

4.3.3. Reliability Test

Hair et al. (2020) define reliability as the condition under which both the Cronbach's Alpha and Composite Reliability values for a variable exceed 0.7 [26]. When the Average Variance Extracted (AVE) method is applied, a variable is deemed reliable when its AVE value exceeds 0.5 [26]. Table 14 presented the result of reliability test, which shows that all variables are reliable.

Table 14. Reliability test result.

Variable	*Cronbach's Alpha*	*Composite Reliability (rho_a)*	*Composite Reliability (rho_c)*	*AVE*	*Result*
IQ	0.911	0.912	0.929	0.651	Reliable
IU	0.870	0.871	0.906	0.660	Reliable
SQ	0.928	0.933	0.941	0.668	Reliable
UQ	0.825	0.827	0.877	0.587	Reliable
US	0.861	0.861	0.900	0.642	Reliable
NB	0.906	0.907	0.928	0.682	Reliable

4.4. Structural Model (Inner Model) Analysis

4.4.1. Collinearity Statistics (VIF)

In a regression model, the Variance Inflation Factor (VIF) is employed to assess the presence of collinearity or the link between two or more independent variables. A regression model is considered satisfactory when there is no collinearity, evident when the VIF score is less than 3.3 [27]. The collinearity test conducted on the research respondents revealed a VIF value of less than 3.3, indicating that the model exhibited no collinearity.

Table 15. Collinearity test result.

Variable	*IQ*	*IU*	*NB*	*SQ*	*UQ*	*US*	*Result*
IQ						2.479	free
IU						1.989	free
NB							
SQ						2.772	free
UQ						3.159	free
US			1				free

According to Table 15, all parameter values did not experience collinearity, indicating that all variables can be used in this research model.

4.4.2. R Square (R^2)

R Square is a metric utilized to quantify the extent to which dependent variables are influenced by independent variables. R^2 is a metric with a range of 0 to 1, with higher values indicating superior predictive performance of the proposed research model. There are three categories of grouping on the R^2 value, namely $R^2 \geq 0.75$ is a strong (substantial) category, $0.50 \leq R^2 < 0.75$ is a moderate category, $0.25 \leq R^2 < 0.50$ and is a weak category [28].

Table 16. R square result.

Variable	*R-square*	*R-square adjusted*	*Result*
User Satisfaction (US)	0.650	0.649	Moderate
Net Benefits (NB)	0.683	0.682	Moderate

According to the R Square values presented in Table 16, the subsequent can be elucidated:

1. The R² value of the User Satisfaction variable is 0.650. This indicates that the User Satisfaction variable can be affected by the System Quality, User Quality, Information Quality, and Information Use variables to the extent of 65%. An additional 35% is subject to the influence of factors that were not investigated in the present investigation.
2. The R² value of the Net Benefits variable is 0.683. This indicates that the Net Benefits variable is 68.3% influenced by the System Quality, User Quality, Information Quality, Information Use, and User Satisfaction variables. The remaining 31.7% are affected by additional variables that were not considered in this research.

4.4.3. Predictive Relevance (Q^2)

Predictive Relevance (Q^2) is used to test how well the observation values are generated using the blindfolding process [29]. There are three categories of grouping on the Predictive Relevance (Q^2) value, namely $Q^2 > 0.50$ is a large category, $0.25 \leq Q^2 \leq 0.50$ is a medium category, and $Q^2 < 0.25$ is a small category. A good model for use in research should have $Q^2 > 0$. The larger the Q^2 value, the greater the predictive relevance of the research model.

Table 17. Predictive relevance result.

Variable	*Q² predict*	*Result*
User Satisfaction (US)	0.632	Large predictive relevance
Net Benefits (NB)	0.589	Large predictive relevance

The predictive relevance (Q2) value of the dependent variables is greater than zero, as shown in Table 17. As a result, this research model demonstrates strong predictive relevance.

4.4.4. Model Fit

Model fit is employed to assess the mathematical correspondence between the research model and the available set of observations. The Standardized Root Mean Square Residual (SRMR) and the Normal Fit Index (NFI) are the two testing models utilized in this investigation. A model is considered fit, as defined by Hair et al. (2019), when the SRMR value is below 0.08 and the NFI value falls within the range of 0 to 1 [29].

Table 18. Model Fit result.

	Saturated model	*Estimated model*	*Result*
SRMR	0.063	0.075	Fit
NFI	0.777	0.772	Fit

Based on the SRMR and NFI values in Table 18, it is shown that the model of Implementation Success of the Forest Management Information System (FMIS) at forestry company is a good model to be accepted.

4.4.5. Goodness of Fit Index (GFI)

The Goodness of Fit Index (GFI) is utilized to assess the practicability of the study model's overall performance [28]. When both the measurement model (outer model) and the structural model (inner model) satisfy the condition that $0 < GFI \leq 1$, with a value closer to 1 being considered more feasible, it can be concluded that they are feasible.

Table 19. Goodness of Fit Index test result.

Variable	*AVE*	*R-square*	*Result*
Information Quality (IQ)	0.651		
Information Use (IU)	0.660		
Net Benefits (NB)	0.668	0.683	
System Quality (SQ)	0.587		
User Quality (UQ)	0.642		
User Satisfaction (US)	0.682	0.65	
Average Communality (AC)	0.648		
Average R-square (AR)		0.663	
GFI = $\sqrt{AC \ X \ AR}$	0.656		Fit

According to Table 19, the research model has a GFI value of 0.656, which means it can adequately explain the empirical data.

4.4.6. PLS Predict

To estimate model parameters and evaluate a model's predictive potential, PLS predict relies on the ideas of distinct training and holdout samples. To estimate the model parameters, such as the loadings, path coefficients, and indicator weights, a subset of the total dataset is utilized, known as a training sample. We call the remaining portion of the dataset that wasn't utilized for model estimation the holdout sample. Using the values for the indicators of the independent constructs in the holdout sample and applying the model estimates from the training sample, PLS predict generates predictions of the indicators of the dependent constructs that have been chosen. These are the in-sample predictions that are computed for the training sample examples. On the other hand, the anticipated values for the holdout sample cases are based on out-of-sample calculations. A tiny discrepancy between the anticipated and actual out-of-sample case values indicates the model's predictive solid capacity.

Conversely, poor predictive ability is shown by a large gap between the projected and actual out-of-sample case values. Researchers might also anticipate that the in-sample predictions will be more accurate than the out-of-sample predictions because the model was estimated using the in-sample training instances. The model over-fits the training sample if there are huge disparities between the magnitudes of the in-sample and out-of-sample deviations between predicted and actual values. A lack of predictive capacity is a typical result of over-fitting.

Table 19. PLS predict

Indicator	***Q^2 predict***	***PLS-SEM***		***LM***	
		RMSE	***MAE***	***RMSE***	***MAE***
NB1	0.439	0.465	**0.357**	0.481	0.339
NB2	0.465	0.499	**0.375**	0.514	0.368
NB3	0.427	0.504	0.377	0.53	0.384
NB4	0.412	0.527	0.388	0.556	0.392
NB5	0.342	0.510	0.390	0.54	0.4
NB6	0.372	0.463	**0.370**	0.471	0.351
NB7	0.277	**0.611**	**0.497**	0.594	0.472
NB8	0.399	0.519	**0.394**	0.53	0.378
US1	0.425	0.470	**0.351**	0.481	0.345
US2	0.448	0.487	0.344	0.522	0.36
US3	0.402	0.533	0.377	0.556	0.406
US4	0.409	0.509	0.357	0.526	0.364
US5	0.463	**0.463**	0.333	0.458	0.317
US6	0.428	**0.470**	0.341	0.455	0.317
PLS-SEM < LM	17 out of 28				
Result	medium predictive power				

PLS predict assesses structural model predictive power beyond the research sample [30]. PLS predict compares PLS-SEM (partial least squares structural equation modelling) RMSE and MAE values to LM values. Four categories make up the PLS predict value:

1. PLS-SEM < LM for all indices. The model has predictive solid potential if LM lowers RMSE and MAE for all PLS-SEM indicators.
2. PLS-SEM < LM for most indices. A majority (or the same number) of PLS-SEM indicators smaller than the LM suggests modest predictive power.
3. PLS-SEM < LM for a few indices. A research model with low predictive potential has a few PLS-SEM markers below LM.
4. No signs show PLS-SEM < LM. The research model lacks predictive potential if none of the PLS-SEM indicators are lower than the LM.

The predictive potential of the model developed from this study is medium, as shown in Table 19 because the RMSE and MAE values of the majority of the indicators—roughly 17 out of 28 values from the PLS-SEM analysis—are lower than the RMSE and MAE values from LM (Linear Regression Model).

4.4.7. F Square (f^2)

The F Square (f^2) test or effect size is used to evaluate whether a certain variable, when removed from the model, has a relative impact on the endogenous variable. According to Hair et al. (2022), there are three categories of F Square (f^2) values, namely $f^2 \geq 0.35$ is a large category, $0.15 \leq f^2 < 0.35$ is a medium category, and $0.02 \leq f^2 < 0.15$ is a small category [27].

Table 20. F Square result.

Path	***f^2***	***Effect Size***
System Quality → User Satisfaction	0.020	Small
Information Quality → User Satisfaction	0.251	Medium
User Quality → User Satisfaction	0.020	Small
Information Use → User Satisfaction	0.032	Medium
User Satisfaction → Net Benefits	2.158	Large

From the results in Table 20, there is only one path that have a large influence, which is User Satisfaction → Net Benefits. There are two paths that has a medium influence, namely Information Quality → User Satisfaction and Information Use → User Satisfaction. Meanwhile, the other paths have a small influence.

Table 21. Path coefficient result.

Hypothesis	*Original sample (O)*	*Sample mean (M)*	*Standard deviation (STDEV)*	*T statistics (|O/STDEV|)*	*P values*	*Result*
SQ → US	0.141	0.142	0.069	2.047	0.041	H_1 is accepted
IQ → US	0.467	0.467	0.07	6.649	0	H_2 is accepted
UQ → US	0.149	0.15	0.076	1.964	0.05	H_3 is accepted
IU → US	0.151	0.15	0.057	2.641	0.008	H_4 is accepted
US → NB	0.827	0.828	0.031	26.969	0	H_5 is accepted

4.5. Hypothesis Test and Discussion

In order to test hypotheses, the significance of the relationship between variables is determined using the bootstrapping method and the path coefficient (P value) and the T statistic value. A significant relationship between two variables can be established when the P value ≤ 0.05 and the T statistic ≥ the T table [29]. According to Hair et al. (2022), when the significance level is 0.05 and a two-tailed test is conducted, the critical T value (T table) is 1.96 [27]. Fig. 4. shows the result of the bootstrapping method of this research.

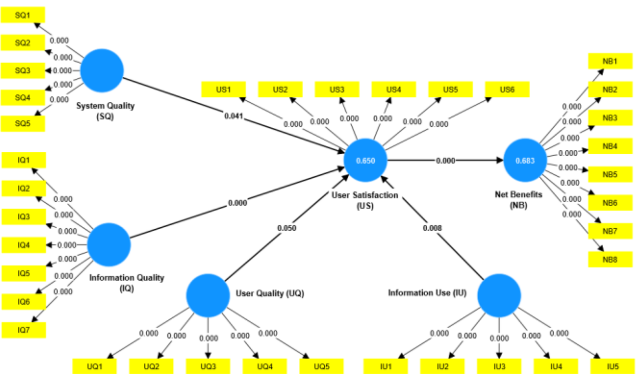

Fig. 4. Bootstrapping result.

Based on the data obtained from the bootstrapping process Fig. 4. and Table 17, the regression equations for the research model can be written as shown in (5) and (6):

$$NB = 0.827\ US + 0.031 \quad (5)$$

$$US = 0.141\ SQ + 0.467\ IQ + 0.149\ UQ + 0.151\ IU + 0.272 \quad (6)$$

Based on the data in Table 21, the factor that contributes the most to the success of the implementation of the Forest Management Information System (FMIS) at forestry company is User Satisfaction (US), which is 0.827.

The analysis of each hypothesis test in this study is as follows:

1. Hypothesis 1 (H_1): User contentment is significantly and positively impacted by system quality.

   The path coefficient (β_{21}) between system quality and user satisfaction is 0.141. The calculated value suggests that there is a positive correlation between system quality and user satisfaction. The user satisfaction test results for system quality indicate a T statistic ≥ 1.96 (valued at 2.047) and a P value ≤ 0.05 (valued at 0.041). Thus, it can be deduced that user contentment is substantially enhanced by system quality. H_1 is accepted and H_0 is rejected on the basis of these analysis results.

2. Hypothesis 2 (H_2): User contentment is significantly and positively impacted by information quality.

   The path coefficient (β22) between information quality and user satisfaction is 0.467. The value of this proportion signifies that user contentment is positively impacted by the quality of the information. The results of the information quality on user satisfaction test indicate a T statistic ≥ 1.96 (valued at 6.649) and a P value ≤ 0.05 (valued at 0). Thus, it can be deduced that user contentment is substantially enhanced by information quality. H2 is admitted and H0 is rejected on the basis of these analysis results.

3. Hypothesis 3 (H_3): User contentment is significantly and positively impacted by user quality.

   The path coefficient (β_{23}) between user quality and user satisfaction is 0.149. The calculated value suggests that there is a positive correlation between user satisfaction and user quality. The user quality on user satisfaction test results indicates a T statistic ≥ 1.96 (valued at 1.964), and a P value ≤ 0.05 (valued at 0.05). Thus, it can be deduced that user contentment is substantially enhanced by user quality. H_3 is admitted and H_0 is rejected on the basis of these analysis results.

4. Hypothesis 4 (H_4): The utilization of information positively and significantly impacts user satisfaction.

   The path coefficient (β_{24}) between information utilization and user satisfaction is 0.151. This numerical value signifies that the utilization of information positively impacts the degree of user satisfaction. The results of the information use on user satisfaction test indicate a T statistic ≥ 1.96 (valued at 2.641) and a P value ≤ 0.05 (valued at 0.008). As a result, it is possible to conclude that the utilization of information substantially enhances user satisfaction. H_4 is admitted and H_0 is rejected on the basis of these analysis results.

5. Hypothesis 5 (H_5): Net benefits are significantly and positively impacted by user satisfaction.

   The path coefficient (β_{11}) between user contentment and net benefits is 0.827. A positive value of c11 signifies that as user satisfaction increases, so do the net benefits derived from the implemented management information system. The user satisfaction test results regarding net benefits indicate a T statistic ≥ 1.96 (valued at 26.969) and a P value ≤ 0.05 (valued at 0). As a result, it is possible to deduce that user satisfaction substantially enhances net benefits. H_5 is admitted and H_0 is rejected on the basis of these analysis results.

5. Conclusion

In reference to Eldrandaly et al. (2015), this study employs a composite of variables derived from the updated DeLone & McLean model and Urbach et al. (2012) to assess the efficacy of a Geographic Information System (GIS)-based Management Information System implementation. The objective is to identify the determinants that impact the successful deployment of the Forest Management Information System (FMIS) within an Indonesian forestry organization.

Based on the conducted analysis, the following can be deduced:

1. Based on the favorable outcomes derived from the evaluation and assessment of all factors—including system quality, user satisfaction, information utilization, system quality, and net benefits—the Forest Management Information System (FMIS) implementation at the forestry company in Indonesia can be deemed a success.
2. The factor that makes the greatest contribution to the successful implementation, as indicated by the path coefficient values, is User Satisfaction (US), which has a value of 0.827. Information Quality (IQ) follows with a value of 0.467, Information Use (IU) at 0.151, User Quality (UQ) with 0.149, and System Quality (SQ) at 0.141.
3. The research findings support the following hypotheses:
   a. User satisfaction is significantly and positively impacted by system quality.
   a. User contentment is significantly and positively impacted by information quality.
   b. Net benefits are significantly and positively impacted by user contentment.
   c. User contentment is significantly and positively impacted by information utilization.
   d. Net benefits are significantly and positively impacted by user satisfaction.

The findings offer significant insights regarding the elements that contribute to the effective execution of an information system, with a particular emphasis on FMIS.

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Author contributions

Artanto Rizky Cahyono: Conceptualization, Methodology, Field study**,** Data curation, Data collection, Writing-Original draft preparation, Visualization, Editing **Dr Ahmad Nurul Fajar:** Methodology, Visualization, Validation, Investigation, Writing-Reviewing, Software.

Conflicts of interest

The authors declare no conflicts of interest.

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