__Original Research Article__

Evaluation of the Success of E-Log Book Implementation for Handline Fishing Gear at Bitung Fishing Port

ABSTRACT

In order to ensure optimal and sustainable management of fishery resources and the preservation of fishery resources, accurate fisheries data is essential. One way to achieve this is by using fishing log books. Improvements have been made by developing an electronic-based fishing log book (e-log book) that is Android-based, paperless, and capable of offline mode. However, an evaluation of the use of e-log books in the perspective of captains, who are the users, has not been conducted. This research aims to assess user satisfaction propensity and evaluate the extent of the success of the implementation of the e-log book for handline fishing gear at Bitung Fishing Port (PPS) using the DeLone and McLean model. The sampling method employed is purposive sampling, with 115 respondents consisting of handline captains who use e-log books. The research was carried out for 3 (three) months in January – March 2023.The data analysis was conducted using propensity test and SEM-PLS. The propensity test results indicate that the implementation of e-log books at PPS Bitung is in the high category at 77.39%. The SEM-PLS analysis results indicate that out of the four proposed hypotheses, not all were supported and accepted. The quality of the system and service influences user satisfaction, and user satisfaction also affects net benefits. However, the quality of information does not impact user satisfaction. The conclusion drawn is that the satisfaction of handline fishing gear captains regarding the implementation of e-log books at PPS Bitung is at a "high" level. Meanwhile, the e-log book application implementation still faces some challenges or aspects that need improvement to achieve the expected level of success.

Keywords: E-log book; Handline; Bitung Fishing Port; DeLone and McLean Model

1. INTRODUCTION

Bitung City, located in the North Sulawesi Province, is an area focused on the development of the fisheries sector [1]. The imposition of a moratorium on permits for foreign vessels since November 2014 has impacted fish processing units, disrupting company operations due to reduced fish supplies [2]. Almost a decade after that event, the marine fisheries in Bitung City have gradually revived. The fisheries production volume in PPS Bitung in 2020 amounted to 53,462 tons, experiencing a production increase of 4,568 tons or a 9.3% rise from 2019 [3]. Bitung City has infrastructure that supports the loading and unloading of goods to and from the city [1]. As an international port, Bitung Port has the capacity to be a gateway for distribution and is closest in distance to export destination countries [4]. Bitung City's export volume, reached 33,876 tons in 2013, while the average from 2004 to 2013 was 23,565 tons [5].

Based on the data from PPS Bitung, there are five main types of fishing gear used: gillnets, handlines, longlines, poles and lines, and purse lines. The dominant landed fish species are skipjack tuna (37%), followed by yellowfin tuna (30%), frigate tuna (17%), bullet tuna (10%), and mackerel (0.8%) [3]. Among these, the primary favourite is tuna or yellowfin tuna due to its high market value. For tuna weighing above 30 kg (30 and above), the price ranges from Rp. 20,000 to Rp. 78,000, based on quality grades such as AB, C, local, and reject [6]. The tuna processing industry in Bitung City comprises fresh tuna, frozen tuna, and tuna loin industries exported to various countries [7]. The implications of the moratorium policy have favoured small-scale fishing enterprises. Fish catch has increased as larger vessels decreased, with fishing grounds closer, thus reducing production costs [2];[8]. Fishing efforts using handlines have promising income prospects, potentially contributing positively to the welfare improvement of fishermen [6]. In 2021, the number of handline fishing gears recorded was 659 units out of 1,088 units, with the highest count in 2020 at 706 units out of a total of 1,118 fishing fleet [3].

Having accurate fishery data is crucial to maintaining the optimal and sustainable management of fishery resources while protecting their sustainability. However, according to Ramdhani et al. [9] and Manshur [10], doubts persist regarding the validity, quality, and updates of fishery data, making it challenging to use in management strategies. Ramdhani et al. [9] recommend establishing a catch recording system adhered to by fishing industry stakeholders and developing easily usable data reporting procedures. Setyadji et al. [11], argue that bound data like logbooks form the foundational principles of fishery management due to their strong spatial, temporal, and strata coverage without requiring substantial costs. Additionally, Trionawan et al. [12] highlight that logbooks offer support for collecting fishery statistical data, including information about fishing areas, fish types, and volumes.

However, traditional logbooks have shortcomings, such as manual entry on paper prone to dirt, damage, loss, readability issues, inaccurate location records, and inefficiencies [12];[13]. To address these limitations, an electronic-based fishing logbook, known as an electronic logbook (e-logbook), has been developed. This application operates on Android, eliminates the need for paper, and functions in offline mode. The adoption of e-logbooks for fishing is considered a crucial step in fisheries management efforts in Indonesia. According to Setyadji et al. [11], the use of e-logbooks represents a significant stride in implementing sustainable fisheries management in Indonesia. Despite some remaining drawbacks, data collected via e-logbooks holds substantial potential as the primary data source for fisheries resource management.

The evaluation of e-logbook usage in fishing, particularly from the perspective of boat captains as users, has yet to be conducted comprehensively. This research aims to assess user satisfaction propensity and evaluate the extent of the success of the implementation of the e-log book for handline fishing gear at Bitung Fishing Port (PPS) using the DeLone and McLean model.

2. METHODOLOGY

2.1. The Scientific Approach

The study took place over three months from January to March 2023 at PPS Bitung, Bitung City, North Sulawesi Province. This research adopted a quantitative methodology focused on collecting and analyzing numerical or statistical data. In this methodology, the variables used to measure the success of e-logbook implementation were based on the DeLone and McLean ISSM (Information System Success Model) framework. The study excluded the usage dimension of e-logbooks due to their mandatory nature, as per Minister of Maritime Affairs and Fisheries Regulation No. 33 of 2021 [14]. The rationale for not including the usage variable in this research was based on arguments put forth by Amriani and Iskandar [15] and Haura et al. [16], stating that the usage variable is difficult to measure in a mandatory context.

Previous studies focusing on the mandatory use of systems have shown inconsistent results. Research by Rai et al. [17] indicated that when usage becomes an obligation, the usage level provides limited relevant information. Therefore, the measure of usage does not always accurately reflect user responses to mandatory information systems [18]. In the context of e-logbooks mandated by the Minister of Maritime Affairs and Fisheries Regulation No. 33 of 2021 [14], this study chooses to leave the usage variable out of the evaluation model because its use is optional. This aligns with a research approach considering the specific context of e-logbook implementation within a mandatory environment. The hypotheses formulated in this study are H1: System quality significantly and positively influences user satisfaction; H2: Information quality significantly and positively influences user satisfaction; H3: Service quality significantly and positively influences user satisfaction; H4: User satisfaction significantly and positively influences net benefits.

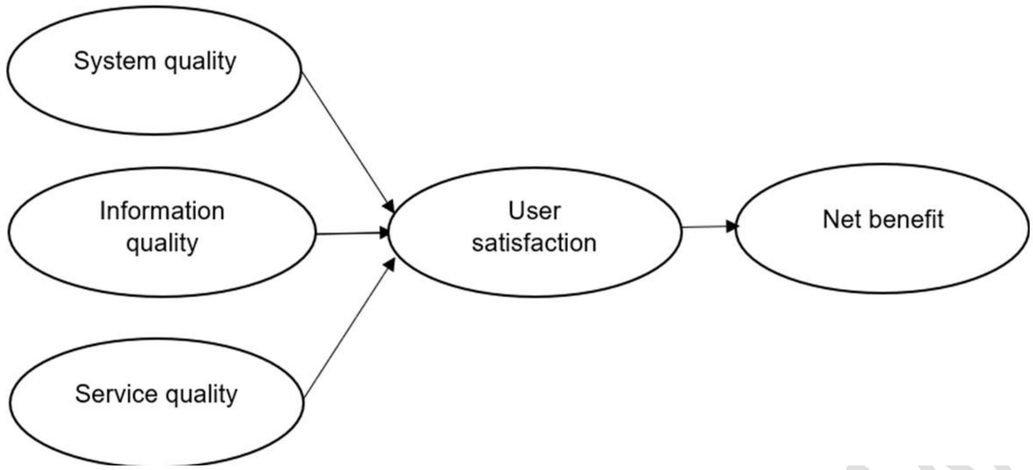

Figure 1. Hypothesis

2.2. Research Variables and Research Instruments

Here are the variables introduced by Delone and McLean in this model:

Table 1. Research Variables

Latent Variables	Operational Definition
System Quality (Exogenous)	User Perception Regarding the Quality of Software Used to Operate the E-logbook for Fish Capture
Information Quality (Exogenous)	The user perception of the e-logbook for fish capture regarding the accuracy, completeness, format, and precision of the information generated by the system.
Service Quality (Exogenous)	The user perception regarding the responsiveness, tangibility, and empathy received/enjoyed by the users of the e-logbook system for fish capture from the management (PPS Bitung) and developers.
User Satisfaction (Endogenous)	Feedback and responses that emerge from users after using the information system.
Net Benefit (Endogenous)	The impact of using the e-logbook for fish capture on users includes job performance, productivity, faster work, and solutions to issues.

Table 1 shows that this study has two dependent (endogenous) variables to be analyzed: user satisfaction and net benefits. Meanwhile, the independent (exogenous) variables used in this study are system quality, information quality, and service quality. Thus, this study will examine the influence of the independent variables (X), namely system quality, information quality, and service quality, on the dependent variables (Y), which are user satisfaction and net benefits. The research instruments are tailored to the indicators of each variable in the Delone and Mclean information.

Table 2. Indicators of each variable

	Indicator	Code	Adopted from
	System Quality		
1	*Ease of use*	SQ1.0	Rahayu *et al*. [19]
2	*Reliability*	SQ2.0	Rahayu *et al*. [19]
3	*Response Time*	SQ3.0	Rahayu *et al*. [19]
4	*Language*	SQ4.0	Iivari [20]
	Information Quality		

1	*Accurate*	IQ1.0	Rahayu *et al*. [19]
2	*Completeness*	IQ2.0	Rahayu *et al*. [19]
3	*Format*	IQ3.0	Rahayu *et al*. [19]
	Service Quality		
1	*Empathy*	SEQ1.0	Rahayu *et al*. [19]
2	*Responsiveness*	SEQ2.0	Rahayu *et al*. [19]
3	*Tangible*	SEQ3.0	Parasuraman *et al*. [21]
	User Satisfaction		
1	Kepuasan Menyeluruh (*Overall Satisfication*)	US1.0	Rahayu *et al*. [19]
2	*Expectation*	US2.0	Chin and Lee [22]
3	*Service*	US3.0	Bailey and Pearson [39]
	Net Benefits		
1	*Job performance*	NB1.0	Rahayu *et al*. [19]
2	*Productivity*	NB2.0	Rahayu *et al*. [19]
3	*Work More Quickly*	NB3.0	Davis [23]
4	*Problem solution*	NB4.0	Yoga *et al*. [24]

2.3. Sampling Method

The sampling method used is purposive sampling. The selection of respondents for the sample includes active fishing boat captains with vessel sizes above 5 Gross Tonnage (GT) who utilize the e-logbook at the Bitung Fishing Port. Considering Ferdinand [25] and Ningsi and Agustina's [26] viewpoints that SEM-PLS calculations do not require strict assumptions about the distribution of observed variables or sample size, not necessitating a large sample—ranging between 30 to 100—this study opted for a sample size of 115 respondents.

2.4. Data analysis

Analyzing propensity for user satisfaction uses validity, reliability and propensity tests. Meanwhile, the method used to analyze the success of e-logbook implementation employs SEM-PLS with the assistance of the SmartPLS software. Partial Least Square (PLS) Structural Equation Model (SEM) is employed to explore the predictive relationships between latent/construct variables by examining the interactions or influences among these latent/construct variables. The discussion starts by evaluating the measurement model (outer model) and the structural model (inner model). The subsequent step involves testing the significance of relationships and influences among variables (hypothesis testing) based on the structural model that has undergone bootstrapping procedures.

3. RESULTS AND DISCUSSION

3.1. Profile of Research Respondents

Before conducting the analysis of the successful implementation of the e-logbook information system, a descriptive analysis was performed to understand the characteristics of the respondents used in the study.

Table 3. The Profile of Respondents in the Handline Captain Research at PPS Bitung

Characteristics	Frequency	Percentage

Age		
21-30	6	5.22%
31-40	36	31.30%
41-50	61	53.04%
51-60	12	10.43%
Level of education		
SD	47	40.87%
SMP	39	33.91%
SMA	28	24.35%
SARJANA	1	0.87%
Gross Tonage (GT)		
1-10	23	20.00%
11-30	86	74.78%
31-60	6	5.22%

The number of respondents involved in this study was 115 individuals. Table 3 shows that the respondents' ages were predominantly 41-50 years, totalling 61 individuals (53.04%). Following that, the age category of 31-40 years consisted of 36 individuals, 51-60 years had 12 individuals, and the lowest category, 21-30 years, included 6 individuals. The education levels of the handline captains ranged from elementary school to bachelor's degrees. Most had completed elementary school (47 individuals, 40.87%), with only one holding a bachelor's degree (0.87%). Regarding the vessel size categories, the 11-30 GT category was dominated by 86 individuals, followed by 1-10 GT with 23 individuals, and lastly, 31-60 GT with 6 individuals.

3.2. *Assess User Satisfaction Propensity*

According to Sugiyono [27], a valid instrument implies a measurement tool used to obtain data (measure) is valid. Validity indicates that the instrument can be utilized to measure what should be measured. It is deemed valid if the significance is less than 0.05 and the R-count is greater than the R-table. Based on the validity test results, it is evident that each item in the questionnaire has an R-count greater than the R-table (0.176) and holds a positive value, as well as all item significances being less than 0.05. Consequently, those statement items are considered valid.

Reliability reflects the level of stability and consistency among respondents in answering questions related to constructs, which constitute dimensions of a variable and are arranged in the form of a questionnaire, with the criterion that a Cronbach's Alpha coefficient greater than 0.6 indicates a reliable questionnaire [28], the results of the reliability test show that the user satisfaction variable has a Cronbach's Alpha value of (0.715) > 0.6. Therefore, the user satisfaction variable can be considered reliable.

There's a calculation based on categorising user satisfaction variables for handline fishing gear at PPS Bitung, involving 115 respondents with a total of 4 questionnaire items. The highest score obtained is 16, and the lowest is 4. Responses are categorized into four groups: AS (strongly agree), A (agree), D (disagree), and SD (strongly disagree). According to Mardapi [29], data categorization is divided into four: very high, high, low, and very low. After determining the minimum score (X min) and maximum score (X max), the ideal average value (Mi) is found using the formula Mi = ½ (X max + X min). The excellent standard deviation (SDi) is calculated using the formula Mi = 1/6 (X max + X min). The scoring criteria guideline is as follows: $X \geq Mi + 1\ SDi$ is very high, $Mi + 1\ SDi > X \geq Mi$ is high, $Mi > X > Mi - 1\ SDi$ is low, and $X < Mi - 1.SBi$ is very low. Based on these calculations, the ideal mean for the user satisfaction variable is 12, and the ideal standard deviation is 4. Based on these calculations, a distribution table of propensity can be created as follows:

Table 4. Distribution of User Satisfaction Variable Categories

Propensity criteria	Frequency	Percentage	Categories
X ≥ Mi + 1 SDi	2	1.74%	Very High
Mi + 1 SDi > X ≥ Mi	89	77.39%	High
Mi > X > Mi - 1 SDi	24	20.87%	Low
X < Mi - 1.SBi	0	0.00%	Very Low

Based on the table above, the frequency of handline fishing gear captains' responses to the implementation of the e-logbook at PPS Bitung falls into the following categories: very high, 2 respondents (1.74%); high, 89 respondents (77.39%); low, 24 respondents (20.87%); and no responses categorized as very low (0.0%). Therefore, the propensity of user satisfaction responses among handline fishing gear captains towards the implementation of the e-logbook at PPS Bitung is categorized as high, encompassing 77.39% of the respondents.

3.3. Implementation of E-Log Book Application

This study employed the Delone and McLean Information System Success Model consisting of 5 latent variables and 17 indicator variables. The data analysis process was conducted using SmartPLS 3.2.9 software. At this stage, the research evaluated the outer model (measurement model) to assess the validity and reliability of the utilized variables. Subsequently, an evaluation of the inner model (structural model) was performed to comprehend the relationships among latent variables. Finally, hypothesis testing was carried out to examine the validity of the proposed hypotheses.

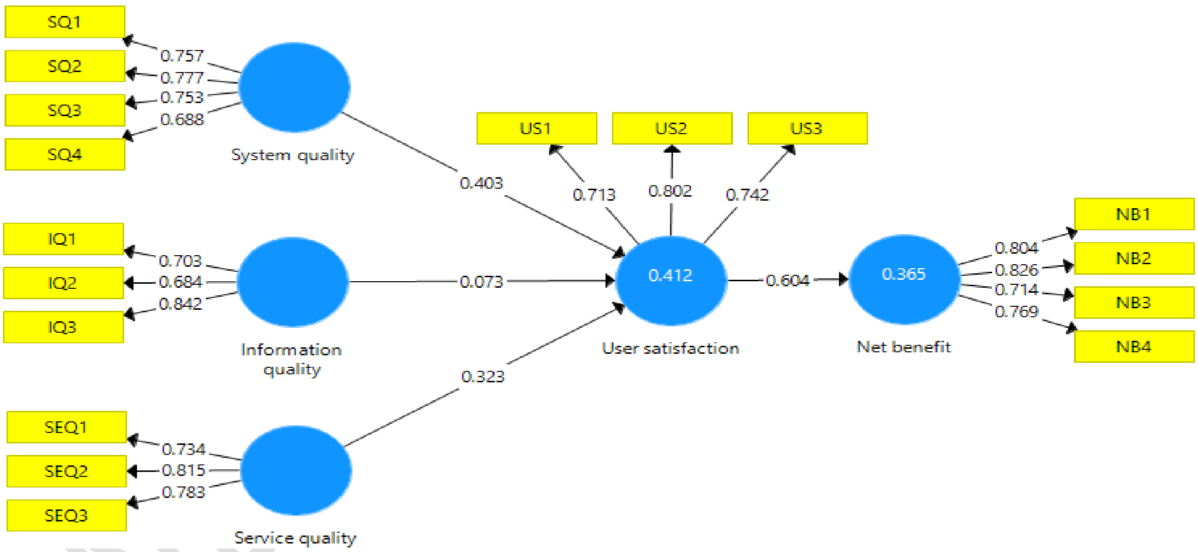

Figure 2. SEM-PLS Analysis Results for Loading Factor Values

The loading factor < 0.5 serves as a parameter for Convergent Validity testing; indicators below this threshold could be considered for removal. However, if an indicator falls between 0.5-0.7 in the loading factor, it might not need to be eliminated, provided the Average Variance Extracted (AVE) score is > 0.5 [30]. The results of the convergent validity calculations can be presented in the table below:

Table 5. Loading Factor Values

	Information quality	Service quality	System quality	User satisfaction	Net benefits
IQ1	0.703				
IQ2	0.684				
IQ3	0.842				
SEQ1		0.734			

SEQ2	0.815			
SEQ3	0.783			
SQ1		0.757		
SQ2		0.777		
SQ3		0.753		
SQ4		0.688		
US1			0.713	
US2			0.802	
US3			0.742	
NB1				0.804
NB2				0.826
NB3				0.714
NB4				0.769

Table 6. *Average Variance Extracted* (AVE)

	Average Variance Extracted (AVE)
Information quality	0.557
Service quality	0.605
System quality	0.554
User satisfaction	0.567
Net benefits	0.607

From Tables 5 and 6, all the research indicator loading factors are above 0.5, and all constructs, including variables such as system quality, information quality, service quality, usage, user satisfaction, and net benefits, have an Average Variance Extracted (AVE) value above 0.5, indicating the validity of these variables. It can be concluded that the test for convergent validity has been fulfilled. Discriminant validity is evaluated by comparing the square root of the Average Variance Extracted (AVE) value with the correlation between constructs. The former should be higher than the latter [31]. The discriminant validity test uses the Fornell-Larcker Criterion, as indicated by the results in Table 7.

Table 7. The Fornell-Larcker Criteria

	User satisfaction	Information quality	Service quality	System quality	Net benefits
User satisfaction	0.753				
Information quality	0.410	0.746			
Service quality	0.495	0.434	0.778		
System quality	0.552	0.490	0.350	0.744	
Net benefits	0.604	0.453	0.263	0.625	0.779

The results in Table 7 indicate that all variables exhibit good discriminant validity, where the square root of the Average Variance Extracted (AVE) for each construct is higher than the correlation value between one variable and another. This suggests that the Fornell-Larcker Criterion for discriminant validity is valid. Based on the cross-loading and Fornell-Larcker Criterion results, it can be concluded that each indicator used has sufficient discriminant validity to represent its respective variable. The reliability test is conducted using composite reliability to assess the reliability of the measurement tool. The composite reliability value should be greater than 0.7, although a value of 0.6 is still acceptable [32]. Based on the construct test results in

Table 8 above, it's evident that all variables have composite reliability values > 0.78. This indicates that all tested variables meet the recommended criterion of > 0.70, demonstrating high levels of reliability for these variables.

Table 8. Results of *Composite Reliability*

	Composite Reliability
Information quality	0.789
Service quality	0.821
System quality	0.832
User satisfaction	0.797
Net benefits	0.861

The structural model's feasibility test involves calculating R-squared (R2) values. This analysis helps determine the extent of the exogenous variables' influence on the endogenous ones. According to Abdillah and Hartono [31], a higher R2 value signifies a better predictive model. Ghozali [33] suggests an R2 of 0.67 indicates a well-categorized model. An R2 result between 0.33 and 0.67 suggests a moderately categorized model. Meanwhile, an R2 value of 0.33 suggests a weakly categorized model. The user satisfaction results at 0.412 fall into the moderate category. This means that the user satisfaction construct can be determined by system, information, and service quality, accounting for 41.2%. For comparison, the remaining 58.8% is influenced by other factors beyond this research. The net benefit exhibits a moderate influence with a result of 0.365. This indicates that 36.5% of the impact comes from user satisfaction, while factors outside the scope of this study influence the remaining 63.5%.

Tabel 9. Nilai *R-square*

	R-square
User satisfaction	0.412
Net benefit	0.365

In analyzing correlations between variables, hypothesis testing is employed to assess the significance of the relationships among these variables. If the path coefficient is > 0, it's interpreted as a positive influence. Conversely, if the path coefficient is < 0, it's interpreted as a negative influence [30]. T-statistics and P-values are used to determine significance. This study uses a two-tailed significance level, with a T-statistic value of 1.96 and a P-value of 0.05 (significance level = 5%) [34].

Table 9. Results of hypothesis tests

Hypothesis	Original Sample (O)	T Statistics	P Values	Conclusion
Information quality ⇒ User satisfaction	0.073	0.496	0.620	Rejected
Service quality ⇒ User satisfaction	0.323	2.481	0.013	Accepted
System quality ⇒ User satisfaction	0.403	4.316	0.000	Accepted
User satisfaction ⇒ Net benefits	0.604	10.799	0.000	Accepted

The parameter estimation for testing the influence of Information Quality on User Satisfaction shows an original sample/path value of 0.073, which is positive. The T-Statistic value of 0.496 is smaller than the Z α = 0.05 (5%) = 1.96. A P-value of 0.620 > 0.05 indicates that Information Quality has a positive yet insignificant effect on User Satisfaction. The hypothesis proposing that Information Quality has a positive but insignificant impact on User Satisfaction is rejected.

Information Quality denotes the quality of outputs generated by the information system, such as the data from the e-log book concerning fishing activities. The expectation is for accurate, complete, and precise data and information to support the implementation of measurable fishing policies, especially in the planning of the fishing sector. For the captains, these reports become a requirement for the next ship's departure documents. Surprisingly, the quality of information does not affect user satisfaction. Despite the assistance provided by the Information Quality in the e-log book application for users' reporting and fisheries data recording, users have not attained adequate satisfaction. This outcome aligns with the findings of Rachman [35], Amriani and Iskandar [15], and Bahrudin et al. [36].

The parameter estimation for testing the influence of Service Quality on User Satisfaction indicates an original sample/path value of 0.323, which is positive. The T-Statistic value of 2.481 is greater than the $Z\ \alpha = 0.05$ (5%) = 1.96. A P-value of $0.013 < 0.05$ suggests that Service Quality has a positive and significant impact on User Satisfaction. In other words, the hypothesis is accepted. This study found that the services provided to users of the information system, such as empathy, responsiveness, and tangible aspects, contribute to user satisfaction with the system. This indicates the significance of these constructs. These findings support the Information System Success Model by DeLone and McLean [37], asserting that service quality is one dimension of information system success. The impact of service quality on user satisfaction is consistent with Rachman [35], Arfian et al. [38], and Meilani et al. [40].

The parameter estimation for testing the influence of System Quality on User Satisfaction indicates an original sample/path value of 0.403, which is positive. The T-Statistic value of 4.31 is greater than the $Z\ \alpha = 0.05$ (5%) = 1.96. With a P-value of $0.00 < 0.05$, it suggests that System Quality significantly impacts User Satisfaction. In other words, the hypothesis is accepted. This implies that an improvement in System Quality leads to an increase in User Satisfaction, and conversely, a decrease in System Quality leads to a reduction in User Satisfaction. These findings align with Iivari's [20] study on mandatory accounting and financial information system implementation. The results are also consistent with research by Bahrudin et al. [36], Noviyanti [41], Pambudi [42], Amriani and Iskandar [15], and Meilani et al. [40].

The parameter estimation for testing the influence of User Satisfaction on Net Benefits indicates an original sample/path value of 0.604, which is positive. The T-Statistic value of 10.79 is greater than the $Z\ \alpha = 0.05$ (5%) = 1.96. With a P-value of $0.00 < 0.05$, it suggests that User Satisfaction significantly impacts Net Benefits. In other words, the hypothesis is accepted. This implies that an increase in User Satisfaction leads to an increase in Net Benefits, and conversely, a decrease in User Satisfaction leads to a reduction in Net Benefits. The direct effect of User Satisfaction on Net Benefits is 0.604, indicating that a one-unit increase in User Satisfaction can result in a 60.4% increase in Net Benefits. The sense of satisfaction stemming from the improved transition from logbook to e-log book, meeting the needs for task completion, instills confidence in users about the e-log book's performance, influencing productivity and task efficiency. These findings further reinforce previous studies by Amriani and Iskandar [15], Haura et al. [16], and Meilani et al. [40].

4. CONCLUSIONS

The conclusion drawn based on the analysis results is as follows:

1. The satisfaction of handline gear captains regarding the implementation of the e-log book at PPS Bitung is categorized as high at (77.39%). This high level of satisfaction among captains is evidenced by respondents' ratings, indicating fulfilled services and expectations as they no longer need to jot down details on paper, satisfying users, particularly captains, and encouraging them to revisit the e-log book application.
2. The implementation of the e-log book application in the handline gear at PPS Bitung can only empirically be considered successful based on some approaches used in the DeLone and McLean success model. Not all of the four proposed hypotheses could be confirmed and accepted. The research results indicate that system quality and service quality influence user satisfaction, and user satisfaction also impacts the net benefits obtained. However, the quality of information was not found to influence user satisfaction significantly.

Thus, the e-log book application implementation still faces several challenges or aspects that need improvement to achieve the expected level of success according to the DeLone and McLean success model. The Ministry of Maritime Affairs and Fisheries, specifically the Directorate General of Capture Fisheries (DJPT) and Directorate of SDI Management (DPSDI) can consider these findings as a scientific basis for decision-making in system improvement and determining steps to enhance the success of e-log book implementation. Strengthening and expanding the application of the e-log book is crucial for improving the quality and accuracy of fisheries data. DJPT, through DPSDI, is urged to review and enhance the quality of information while the system and service quality could be further improved, supporting the agenda for measurable fisheries capture implementation.

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