Analysis of the Determinant Factors of Decision-Making Quality in ERP Applications

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Abstract

Organizations increasingly deploy cloud-based Enterprise Resource Planning (ERP) systems to achieve real-time data integration and operational efficiency, yet prior research has emphasized their transactional functions and given limited attention to how ERP quality dimensions support managerial decision-making, with most studies examining only mediated relationships. The objective of this study is to analyse the direct and indirect influence of Information Quality, System Quality, and Service Quality on Decision-Making Quality, with User Satisfaction as a mediating variable, drawing on the DeLone and McLean Information System Success Model. Its contribution and novelty lie in modelling Decision-Making Quality as a distinct outcome construct and in testing the direct paths from the three quality dimensions to decision quality alongside the mediated ones, which prior ERP research has rarely examined. Data were collected through an online five-point Likert-scale questionnaire from ERP users in Batam, Indonesia, yielding 399 valid responses analysed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS. All seven hypotheses were supported. Information Quality was the strongest determinant, affecting User Satisfaction ($\beta = 0.535$) and Decision-Making Quality ($\beta = 0.429$), followed by System Quality ($\beta = 0.254$) and Service Quality ($\beta = 0.102$); User Satisfaction significantly influenced Decision-Making Quality ($\beta = 0.200$) and acted as a partial mediator. The model explained 69.6% of the variance in Decision-Making Quality ($R^2 = 0.696$) and 54.5% in User Satisfaction ($R^2 = 0.545$). Because the design is cross-sectional and self-reported, the findings are interpreted as statistical associations rather than causal effects. Practically, the results recommend that organizations prioritise the accuracy, timeliness, and relevance of ERP information to strengthen managerial decision-making.

Keywords: Cloud ERP, Information Quality, System Quality, Service Quality, User Satisfaction, Decision-Making Quality, PLS-SEM

1. Introduction

In today's digital era, the deployment of cloud-based Enterprise Resource Planning (ERP) applications has become a strategic priority for Organizations looking to enhance the effectiveness and efficiency of resource management. Cloud ERP provides real-time data integration across departments, accelerates operational processes, and provides more accurate and timely information to support organizations decision-making. As cloud ERP platforms mature, vendors have been expanding their analytical capabilities, embedding dashboards, predictive modules and integration tools that were not available in earlier generations of ERP software. Recent research supports the notion that ERP systems remain central to enterprise digital transformation, with system and information quality continuing to affect user experience and organizations outcomes in current cloud-based deployments [1].

However, most ERP-success research focuses on user satisfaction and continuance intention rather than the direct contribution of ERP quality to managerial decision-making. A study of ERP user information processing in a large shipbuilding and marine-engineering firm found that user satisfaction was positively affected by system quality, service quality, and user interaction, though perceived usefulness alone had no significant effect, indicating that user-level mechanisms continue to mediate the organizational benefits of ERP [1]. Another study, applying a push-pull-mooring framework to ERP switching, found that system quality, information quality, and top management support significantly shaped user satisfaction, which in turn influenced users' intention to continue with or abandon their ERP system [2]. A

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2024 PLS-SEM study in an Indonesian educational context confirmed that information-system quality significantly and positively affects user satisfaction, holding across system types, industries, and user populations [3]. A recent ERP study confirmed that system-related and organizational factors are key determinants of user satisfaction and continued loyalty toward ERP systems [4]. A study of ERP post-implementation success at a large Indonesian state-owned construction company integrated the Task-Technology Fit model into the DeLone and McLean IS Success Model and found that perceived usefulness, user satisfaction, and task-technology fit positively affected ERP's organizational impact [5]. Together, these findings reinforce that ERP value is still largely transmitted to organizations indirectly, through individual users' satisfaction and behavior, rather than through a direct technical pathway to better decisions.

2. Literature Review

2.1. ERP Quality and Decision-Making Quality

A more direct empirical test examined how ERP system quality dimensions influence decision-making quality in large Moroccan companies [6]. Using survey data from 104 ERP-using decision-makers and PLS-SEM, it found that information and system quality positively influenced users' overall ERP experience, while service quality had a negative effect, which in turn shaped decision quality [6]. However, these relationships were tested mainly through user satisfaction as an intervening mechanism rather than a direct path. This gap matters because newer cloud ERP systems have analytical capabilities well beyond those studied in 2021, making the unexamined direct pathways increasingly relevant.

2.2. The DeLone and McLean IS Success Model and Research Gap

This gap is increasingly relevant as cloud ERP platforms expand their analytical and integration capabilities. Limited empirical attention has been given to how Information Quality, System Quality, and Service Quality, the three quality dimensions of the DeLone and McLean (D&M) Information Systems Success Model, affect Decision-Making Quality both directly and indirectly through User Satisfaction in a cloud ERP context. The D&M model conceptualizes IS success through six interrelated dimensions: System Quality, Information Quality, Service Quality, Use, User Satisfaction, and Net Benefits, and remains one of the most widely adopted evaluation frameworks in recent research [7]. In its extended form, Service Quality is a distinct antecedent alongside System and Information Quality, reflecting the growing role of IS/IT support in shaping user satisfaction and net benefits [8]. It continues to serve as the standard framework for evaluating IS success in recent ERP and information-systems studies [1], [3], [5], [9], [10].

Within this framework, Decision-Making Quality is positioned as a specific, decision-oriented outcome rather than a restatement of the broader Net Benefits dimension. Whereas Net Benefits typically aggregates diverse organizational and individual gains such as productivity, efficiency, and cost savings, Decision-Making Quality narrows the focus to the accuracy, precision, and reliability of the decisions that users reach on the basis of ERP-generated information. Treating this construct as a distinct outcome allows the model to examine the analytical, decision-support contribution of ERP quality dimensions explicitly, which is the specific gap this study seeks to address.

2.3. Research Objectives and Methodological Approach

Therefore, this study aims to bridge the existing research gap by developing and testing a research model that examines the direct relationships between ERP Information Quality, System Quality, and Service Quality on Decision-Making Quality, with ERP User Satisfaction positioned as a mediating variable, within the context of cloud-based ERP applications. This study offers a theoretical contribution by extending the D&M IS Success Model within the context of modern cloud ERP platforms, and a practical contribution by providing recommendations for organizations and ERP consultants seeking to optimize ERP service quality to support more effective managerial decision-making.

Data were collected through a Likert-scale questionnaire and analyzed using PLS-SEM, a technique well suited to exploratory research models with moderate sample sizes and non-normally distributed data. The User Satisfaction construct was operationalized using items adapted from the End-User Computing Satisfaction (EUCS) instrument, a widely used measurement scale that remains in active use, consistent with the continued centrality of user satisfaction as a measure of information-system success across a wide range of systems [11].

2.4. Hypothesis Development and Quality Dimensions and ERP User Satisfaction

The hypotheses are developed as follows. Information quality, the degree to which ERP-generated information is accurate, timely, relevant, and complete, shapes how users perceive the value of the output for their tasks. An ERP success study found that ERP quality and its alignment with business strategy jointly shape ERP success and the benefits organizations obtain, underscoring the role of quality in shaping outcomes [12]. In the cloud ERP context, accurate, relevant, and interpretable information positively affects user satisfaction:

H1: Information Quality has a significant positive effect on ERP User Satisfaction.

A reliable, flexible, easy-to-use system with fast response time directly affects user satisfaction. System quality, covering equipment availability and reliability, ease of use, and response time, reflects the outcome of the interaction between users and the system and helps determine whether it is used at all. It has been identified as a major determinant of user satisfaction in ERP environments, alongside service quality and user participation [1], [2]. In the cloud ERP context, a stable, responsive, easy-to-use system increases overall satisfaction:

H2: System Quality has a significant positive effect on ERP User Satisfaction.

Service quality, technical support, training, and responsiveness, influences user satisfaction in information-system environments [1]. Defined as the gap between expected and delivered service, its dimensions of reliability, assurance, empathy, and responsiveness significantly affect satisfaction [13], with responsiveness and communication particularly important as the speed and accuracy of service delivery raise satisfaction [14]; comprehensive training and technical support remain necessary complements [12]. Management support, a related organizational service dimension, is among the strongest predictors of user satisfaction in ERP-using manufacturers [4]. In the cloud ERP context, responsive and competent support, training, and maintenance positively affect satisfaction:

H3: Service Quality has a significant positive effect on ERP User Satisfaction.

User satisfaction is consistently identified as a key mechanism through which IS quality translates into downstream benefits, including decision quality [1], [2], [3], [5], [6]. Decision quality reflects the extent to which decision outcomes match or surpass expectations, and ERP user satisfaction contributes to departmental efficiency and to the timely, flexible provision of information for decision-making. This mechanism has been shown directly, with ERP user satisfaction shaping the quality of subsequent decisions [6]. In the cloud ERP context, satisfied users make higher-quality decisions using the system:

H4: ERP User Satisfaction has a significant positive effect on Decision-Making Quality.

Beyond its indirect effect through satisfaction, information quality may influence decision quality directly, since decision-makers rely on accurate, complete information when evaluating options. Firms increasingly treat the quality of their data and analytics as a driver of decision-making and business performance [15]. Studies of decision support systems and big data consistently find that the quality of underlying data is a primary predictor of efficient decisions [16], [17], and evidence from digital accounting systems shows that information quality significantly enhances decision-making quality even where system quality alone does not [18], [19]. The principle extends to other decision-intensive domains such as computer-aided medical diagnosis, where output accuracy and interpretability directly affect decision quality [20], [21]. One empirical model treated information quality as a direct antecedent of the ERP experience that shaped decision quality [6]. In the cloud ERP context, accurate, timely, complete information enables higher-quality decisions even before satisfaction fully forms:

H5: Information Quality has a significant positive effect on Decision-Making Quality.

System quality may also directly influence decision quality, as a stable, reliable, fast system reduces the friction of retrieving and acting on data. An integrated, accessible system stores information consistently in a single database, easing management's evaluation of operations. Evidence on the centrality of system quality to ERP outcomes [1], [2], on system quality shaping the ERP experience underlying decision quality [6], and on analytics and business-intelligence tools strengthening decision-making [16] jointly suggests that technical performance, not only its mediated effect through satisfaction, influences decision quality. In the cloud ERP context, a reliably and efficiently performing system positively affects decision quality:

H6: System Quality has a significant positive effect on Decision-Making Quality.

Finally, the quality of service and support around an ERP system can also have a direct bearing on decision-making quality. Responsive technical support reduces the delays and errors that might otherwise impede a decision-maker's ability to act on system outputs in a timely manner. The quality of decision-making in an organization depends on the availability of current, accurate and reliable information, the competence of the decision-maker and the operational processes that can produce objective, data-driven decisions. The study of e-government in Indonesia found that the dimensions of service quality such as responsiveness and reliability had a significant effect on net benefits, such as more effective decisions by the users of digital government services [22]. There is also a measurable negative direct effect of service quality on the overall ERP experience that influenced decision quality, indicating that service quality failures could directly undermine decision outcomes rather than only acting through satisfaction [6]. When using cloud ERP, the quality of decisions made through the system will be influenced when the technical support and service delivery are timely and competent. The hypothesis can therefore be formulated as follows:

H7: Service Quality has a significant positive effect on Decision-Making Quality.

3. Methodology

3.1. Method

This research uses a quantitative approach. The quantitative method is suitable because the study relies on numeric data collected through a structured questionnaire to gauge respondents' perceptions of the constructs being studied. The approach is used to systematically examine the hypothesised relationships among the independent, mediating, and dependent variables specified in the research model. Because the study employs a cross-sectional, self-reported survey design, these relationships are interpreted as statistical associations and hypothesised effects rather than definitive causal relationships. The overall research process followed in this study is summarized in the flowchart in figure 1, which proceeds from problem identification and hypothesis development through data collection and screening to measurement-model and structural-model evaluation, and finally to hypothesis testing and mediation analysis.

3.2. Research Models

The research model of this study is built by adapting the DeLone and McLean IS Success Model to the context of the cloud-based ERP applications. The model proposes three quality dimensions as exogenous constructs namely Information Quality, System Quality and Service Quality which directly and indirectly (through the mediating variable ERP User Satisfaction) influence Decision-Making Quality. It is hypothesized that each quality dimension directly influences ERP User Satisfaction (H1-H3) and User Satisfaction directly influences Decision-Making Quality (H4). Moreover, the three quality dimensions are hypothesized to have a direct effect on Decision-Making Quality (H5-H7). This allows the study to test the direct paths, which have not received much empirical attention in the previous studies. The full research model and the hypothesized relationships are shown in figure 2.

The model in this study is a research model proposed from the seven hypotheses (H1–H7) developed from the literature review provided in Section I. The relationships below are based on a proposed model; the hypothesized model of the researcher before conducting the empirical validation. The strength, sign and direction of each of the paths are derived from the subsequent PLS-SEM analysis and not assumed a priori. The proposed research model includes three independent variables, one mediating variable, and one dependent variable. The independent variables are ERP Information Quality (X1), ERP System Quality (X2), and ERP Service Quality (X3); the mediating variable is ERP User Satisfaction (Z); and the dependent variable is Decision-Making Quality (Y).

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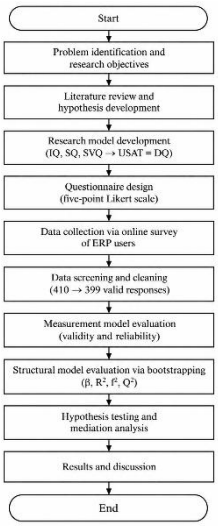


Figure 1. Flowchart of the research process

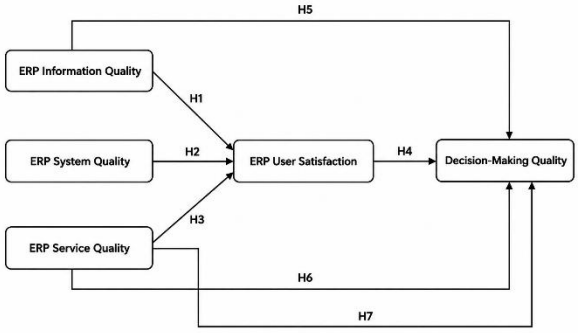


Figure 2. Research Model

3.3. Population and Sampling

The population of this study is the people in Batam who use ERP systems or understand enough about ERP, either directly through operational use or familiar with the functionality. There is no official record of the total number of ERP users in Batam, and so the exact size of this population is unknown. Hence, this study follows the non-probability sampling technique. The sample was selected using a purposive sampling technique, in which respondents were chosen based on criteria relevant to the research objectives. A respondent was eligible if they used an ERP system in their work or operational activities, or if they possessed an adequate understanding of ERP in terms of its use or underlying functionality.

This resulted in a total of 410 responses, which were then screened for data quality prior to analysis. Of these, 8 responses were removed because the respondents answered "no" to the screening question asking whether they had ever used an ERP system, and were therefore ineligible for the study. A further 3 responses were removed as careless responses, identified through invariant, straight-lined answering in which the respondent selected the same option across all items. Cases were excluded solely on the basis of respondent eligibility and data quality, and not because their answers differed from any hypothesised outcome. This screening yielded a final sample of 399 valid respondents that was used for the subsequent analysis. The sample size exceeds the minimum number typically required for PLS-SEM analysis of models with comparable complexity, providing statistical robustness and representativeness of the findings in line with recent applications of PLS-SEM to survey-based organizational research [23].

Although the inclusion criteria admitted both active operational users and respondents with sufficient functional understanding of ERP, all respondents were required to have direct exposure to ERP outputs in a work or organizational context, ensuring that they could meaningfully evaluate the information, system, and service quality of the ERP they interacted with. This purposive strategy was adopted because no official register of ERP users in Batam exists, which precludes probability sampling. It is nonetheless acknowledged that combining operational users with conceptually knowledgeable respondents introduces a degree of respondent heterogeneity; this is treated as a limitation and, together with the single-source, self-reported nature of the data, the potential for common method bias is addressed in the limitations of the study. Table 1 summarizes the demographic profile of the 399 valid respondents.

Table 1. Demographic Profile of Respondents (N = 399)

Characteristic	Category	Frequency	Percentage (%)
Job title / position	Staff	243	60.9
	Supervisor	114	28.6
	Manager	42	10.5
Duration of ERP use	Under 6 months	18	4.5
	6 months – 1 year	40	10.0

	1 – 3 years	114	28.6
	3 years or above	227	56.9

In terms of organizational position, the majority were staff-level employees (60.9%), followed by supervisors (28.6%) and managers (10.5%), indicating that the sample captures perspectives from both operational and managerial levels of ERP use. With respect to experience, most respondents had used the ERP system for a substantial period: 56.9% for three years or more and 28.6% for one to three years, so that more than 85% of respondents had at least one year of ERP experience. This distribution strengthens the credibility of the responses, as the large majority of participants had sufficient hands-on exposure to evaluate the information, system, and service quality of the ERP they used.

3.4. Data Collection

Data were gathered using a survey method with a five-point Likert-scale questionnaire to measure the respondents' perceptions of each research variable. The scale contained the following levels of assessment: 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree) and 5 (Strongly Agree). The construct of User Satisfaction was operationalized by adapting items from EUCS framework, consistent with its ongoing use in recent information-systems research evaluating enterprise and clinical information systems [24].

The questionnaire was distributed electronically through Google Forms to the respondents who were identified as ERP system users or having adequate understanding of ERP. The survey method was selected because it is a method that can quickly and efficiently gather data in an objective manner. This method allows the researcher to collect a large quantity of answers in a brief amount of time. Additionally, the respondents were able to fill in the questionnaire at their convenience, without the constraints of time and location, by using Google Forms. This also facilitated the data-processing stage, as responses could be exported directly into formats compatible with statistical analysis software.

3.5. Data Analysis

The collected data were analysed using PLS-SEM through the SmartPLS software. PLS-SEM was chosen for its ability to analyse research models with complex structures of variables, such as direct and indirect relationships among constructs. Moreover, PLS-SEM is appropriate for exploratory models and data that do not need to meet the assumptions of normal distribution, and it has recently been used for survey-based structural models in operations research [23].

The analysis follows the standard Partial Least Squares Structural Equation Modeling (PLS-SEM) procedure, following established PLS-SEM guidelines [23], and the five equations below summarize the quantities that SmartPLS computes at each stage; they are not calculated by hand but are reported here to make the analytical basis of the study explicit. Equation (1) is the reflective measurement model: it states that each questionnaire indicator reflects the latent construct it belongs to, together with a small measurement error. Equations (2) and (3) define the two criteria used to confirm that the constructs are well measured, namely the Average Variance Extracted (AVE), which shows how much of the indicators' variance a construct captures (convergent validity), and the Composite Reliability (CR), which measures internal consistency. Equation (4) is the structural model, which expresses each endogenous construct as a weighted combination of the constructs that predict it, where the weights are the path coefficients estimated by the model. Equation (5) defines the effect size (f^2), which indicates how strongly each predictor contributes to a construct, with the values reported in Table 4b.

$$x_i = \lambda_i \xi + \varepsilon_i \tag{1}$$

$$AVE = \frac{\Sigma \lambda_i^2}{\Sigma \lambda_i^2 + \Sigma(1 - \lambda_i^2)} \tag{2}$$

$$CR = \frac{(\Sigma \lambda_i)^2}{(\Sigma \lambda_i)^2 + \Sigma(1 - \lambda_i^2)} \tag{3}$$

$$\eta = \Sigma_j \beta_j \eta_j + \Sigma_k \gamma_k \xi_k + \zeta \tag{4}$$

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$$f^2 = \frac{(R^2(included) - R^2(excluded))}{(1 - R^2(included))} \quad (5)$$

In these equations, x_i is an observed indicator (a questionnaire item), λ_i is its loading on the latent construct ξ, and ε_i is the measurement error; η is an endogenous (dependent) construct, β_j and γ_k are the path coefficients linking the constructs, and ζ is the residual of the structural model. The full sequence of analytical steps is summarized as pseudocode in algorithm 1.

Algorithm 1. Pseudocode of the PLS-SEM analysis procedure

Input : survey responses R (n = 399); research model M (constructs, indicators, paths)
Output: validity and reliability metrics, path coefficients, hypothesis decisions
1 screen and clean R; remove ineligible and careless responses
2 specify reflective measurement model and structural model M
3 run PLS-SEM algorithm to estimate outer loadings and path coefficients
4 for each construct c in M do
5 compute outer loadings, AVE(c), CR(c), Cronbach's alpha(c)
6 if AVE(c) > 0.50 and CR(c) > 0.70 then mark c as valid and reliable
7 end for
8 assess discriminant validity (Fornell-Larcker criterion and HTMT ratio)
9 run bootstrapping (5000 subsamples) to obtain t-values and p-values
10 for each hypothesised path p do
11 if t(p) > 1.96 and P(p) < 0.05 then accept p else reject p
12 end for
13 compute R2, f2, and Q2 for the endogenous constructs
14 estimate specific indirect effects and VAF for the mediation paths
15 return all metrics and hypothesis decisions

Prior to hypothesis testing, the measurement model was evaluated for validity and reliability, following procedures consistent with recent PLS-SEM applications in organizational and healthcare-systems research [25]. Convergent validity was assessed using loading factor values and AVE, with an indicator deemed valid where the loading factor exceeded 0.70 and the AVE exceeded 0.50. Discriminant validity was assessed using the Fornell–Larcker criterion, which stipulates that the square root of the AVE for each construct must exceed its highest correlation with any other construct, together with the Heterotrait-Monotrait (HTMT) ratio, applying a threshold value below 0.90 [25]. Construct reliability was evaluated using Cronbach's Alpha and CR, with a construct deemed reliable where both values exceeded 0.70, consistent with recent reliability-reporting standards in PLS-SEM research [25].

Upon satisfying these criteria, structural model testing was conducted to evaluate the hypothesized relationships among Information Quality, System Quality, Service Quality, User Satisfaction, and Decision-Making Quality. This evaluation was performed through examination of path coefficients, t-statistics, and p-values obtained via the bootstrapping procedure, in conjunction with the coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2), which together informed an assessment of overall model quality [17]

4. Results and Discussion

This section presents the results of the data analysis along with the discussion of the findings. Data was collected through the distribution of an online questionnaire to ERP users in Batam, resulting in 410 responses. After the screening process, 11 responses were removed because they were identified as outliers or did not meet the criteria of the research, leaving 399 valid responses to be processed in the analysis. The data collected were then analysis using the Partial Least Squares Structural Equation Modelling (PLS-SEM) approach with the assistance of SmartPLS software. The analysis was conducted in several sequential stages starting from the evaluation of the measurement model (outer model) to check the validity and reliability of the constructs, followed by the assessment of discriminant validity, the evaluation of the structural model (inner model) through the bootstrapping procedure to test the proposed

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hypotheses, and finally the specific indirect effect test to assess the mediating role of User Satisfaction. PLS-SEM was chosen because it is suitable for exploring complex predictive models and does not require normally distributed data [23].

In the first step of the analysis, the outer model was assessed to make sure that each indicator is a good proxy for the latent construct it is supposed to reflect. The current PLS-SEM guidelines confirm convergent validity when each indicator has an outer loading of at least 0.70 and each construct has an AVE of more than 0.50 while internal consistency reliability is confirmed when Cronbach's Alpha, rhoA, and CR are more than 0.70 [9], [23]. Indicators were excluded from the model before re-estimating the algorithm if they did not meet the minimum loading criterion, meaning that only indicators that met the standards were used.

As shown in table 2, the retained indicators had loading values ranging from 0.701 to 0.895, confirming that each item makes a significant contribution to its underlying construct. Also at construct level, convergent validity was achieved with AVE values of 0.531 for Information Quality, 0.661 for System Quality, 0.779 for Service Quality, 0.738 for User Satisfaction, and 0.567 for Decision-Making Quality, all comfortably above the 0.50 cutoff. Reliability testing resulted in equally satisfactory results: The five constructs had Cronbach's Alpha ranging from 0.745 to 0.859, rhoA ranging from 0.748 to 0.859 and CR ranging from 0.840 to 0.914. Since every criterion of the measurement model has been fulfilled, the research instrument can be regarded as both valid and reliable, providing a sound basis for the subsequent evaluation of the structural model.

Table 2. Measurement Model Indicators

Construct/Indicator	Loading	Cronbach Alpha	A	CR	AVE
Information Quality (IQ)					
The information provided by the ERP system is accurate. (IQ1)	0.727	0.780	0.783	0.850	0.531
The information provided by the ERP system is always available in a timely manner. (IQ2)	0.763				
The information provided by the ERP system is useful for my work. (IQ3)	0.701				
The information provided by the ERP system is easy to understand. (IQ4)	0.723				
The information provided by the ERP system is important for my decision-making process. (IQ5)	0.726				
System Quality (SQ)					
The ERP system responds quickly when in use. (SQ2)	0.794	0.746	0.754	0.854	0.661
The ERP system is easy to use. (SQ3)	0.819				
The ERP system interface can be easily customized to meet my needs. (SQ4)	0.825				
Service Quality (SVQ)					
The information I receive from the IS/IT department is accurate. (SVQ2)	0.885	0.859	0.859	0.914	0.779
The training provided by the IS/IT department improves the quality of my work. (SVQ3)	0.882				
The IS/IT department is able to resolve my issues effectively. (SVQ4)	0.882				
USER SATISFACTION (USAT)					
I am satisfied with the quality of the ERP system. (USAT1)	0.895	0.820	0.826	0.894	0.738
I am satisfied with the quality of the information provided by the ERP system. (USAT2)	0.890				
I am satisfied with the services provided by the IS/IT department. (USAT3)	0.788				
Overall, I am satisfied with the ERP system. (USAT4)					
DECISION MAKING QUALITY (DMQ)					
Based on the information provided by the ERP system, the decisions I make are generally accurate, although minor errors may occasionally occur. (DMQ1)	0.743	0.745	0.748	0.840	0.567
Based on the information provided by the ERP system, the decisions I make are accurate. (DMQ2)	0.795				
Based on the information provided by the ERP system, the decisions I make are precise, producing consistent outcomes when addressing the same problem. (DMQ3)	0.754				

Based on the information provided by the ERP system, the decisions I make are reliable. (DMQ4)	0.719

The results of the convergent validity and reliability tests for each construct, including the outer loading of each indicator, the AVE, CR, and Cronbach's Alpha values, are presented in table 2. The results of the Fornell-Larcker discriminant validity assessment are presented in table 3. The second test was performed to assess discriminant validity, which determines the extent to which each construct in the research model is truly distinct from the other constructs. This assessment was carried out using the Fornell-Larcker criterion, in which the square root of the AVE of each construct, displayed on the diagonal of the matrix, is compared against the relationships between that construct and the model's other constructs. When a construct's diagonal value is greater than all of its correlations with other constructs, discriminant validity is deemed established, meaning that each construct in the model describes a distinct phenomenon that is not represented by any other construct [23]. The results of this test are presented in the table below.

Table 3. Discriminant Validity with Fornell-Larcker Criterion

Construct	DMQ	IQ	SVQ	SQ	USAT
DMQ	0.753				
IQ	0.771	0.728			
SVQ	0.550	0.506	0.883		
SQ	0.666	0.585	0.506	0.813	
USAT	0.695	0.707	0.511	0.548	0.859

As shown in table 3, the square root of the AVE exceeds the inter-construct correlations for System Quality (0.813), Service Quality (0.883), and User Satisfaction (0.859), confirming that these constructs are empirically distinct. For the pair of Information Quality and Decision-Making Quality, however, the two values are very close: their correlation (0.771) is marginally higher than the square root of the AVE of Decision-Making Quality (0.753) and of Information Quality (0.728). This suggests that the empirical separation between these two constructs is limited and warrants closer examination. A plausible explanation is the conceptual proximity of the two scales, as several Information Quality items refer to the usefulness and importance of ERP information for decision-making, while Decision-Making Quality captures the accuracy, precision, and reliability of decisions made on the basis of that information. This overlap is explicitly acknowledged as a limitation of the present measurement model, and the structural results involving Information Quality and Decision-Making Quality should therefore be interpreted with caution. To complement the Fornell-Larcker assessment, the HTMT ratio was additionally examined against the recommended threshold of 0.90; the HTMT results are reported in table 3a.

Table 3a. Discriminant Validity with HTMT Ratio

Construct	DMQ	IQ	SVQ	SQ	USAT
DMQ					
IQ	0.996				
SVQ	0.688	0.613			
SQ	0.884	0.770	0.636		
USAT	0.890	0.873	0.607	0.693	

As reported in table 3a, the HTMT ratios for most construct pairs fall below the conservative threshold of 0.90. However, the HTMT value between Information Quality and Decision-Making Quality is 0.996, far exceeding both the 0.90 and the more stringent 0.85 thresholds. In line with the Fornell-Larcker result, this indicates that Information Quality and Decision-Making Quality are closely related and share a high degree of empirical overlap in this sample. This is noted as a limitation of the measurement model, since part of the strong estimated relationship between the two constructs may reflect conceptual proximity between their items rather than a fully independent effect. Accordingly, the results involving this pair are interpreted with appropriate caution, and refining the operationalization of the two constructs with more clearly differentiated items is suggested as a direction for future research. The results of the structural model estimation, including the path coefficients, t-statistics, and significance levels, are presented in table 4.

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Table 4. Structural Estimate Results

Path			ß	T-stat	P Values	Results
IQ	→	DMQ	0.429	8.345	0.000	Accepted
IQ	→	USAT	0.535	10.708	0.000	Accepted
SVQ	→	DMQ	0.102	2.090	0.037	Accepted
SVQ	→	USAT	0.163	3.906	0.000	Accepted
SQ	→	DMQ	0.254	5.060	0.000	Accepted
SQ	→	USAT	0.152	2.969	0.003	Accepted
USAT	→	DMQ	0.200	4.100	0.000	Accepted

Prior to interpreting the structural results, collinearity among the predictor constructs was assessed using the inner variance inflation factor (VIF). All inner VIF values ranged from 1.48 to 2.30, which is well below the conservative threshold of 3.3. Because full collinearity VIF values below 3.3 also serve as an indicator that common method bias is not a serious concern, this result provides preliminary evidence that the structural estimates are not substantially distorted by multicollinearity or common method variance. Given that the data are nonetheless single-source and self-reported, common method bias is additionally addressed among the limitations of the study.

Table 4 shows that all seven hypothesized paths produce positive path coefficients with T-statistics above 1.96 and P values below 0.05, so every hypothesis proposed in this research is accepted. Among the direct determinants of Decision-Making Quality, Information Quality exerts the strongest influence (β = 0.429, T = 8.345), followed by System Quality (β = 0.254, T = 5.060), User Satisfaction (β = 0.200, T = 4.100), and Service Quality (β = 0.102, T = 2.090). This ordering indicates that the accuracy, timeliness, and usefulness of the information generated by the ERP system constitute the most decisive factor in shaping the quality of decisions made by its users, while the responsiveness and support provided by the IS/IT function, although significant, play a comparatively smaller role. The explanatory power and predictive relevance of the structural model are reported in table 4a.

Table 4a. Coefficient of Determination (R^2) and Predictive Relevance (Q^2)

Endogenous construct	R^2	R^2 adjusted	Q^2
User Satisfaction	0.545	0.542	0.396
Decision-Making Quality	0.696	0.692	0.383

The explanatory power of the model was assessed through the R^2. As shown in table 4a, the model explains 69.6% of the variance in Decision-Making Quality (R^2 = 0.696) and 54.5% of the variance in User Satisfaction (R^2 = 0.545), indicating substantial and moderate explanatory power, respectively. The effect sizes (f^2) in table 4b show that Information Quality has the strongest effect on both User Satisfaction (f^2 = 0.377, large) and Decision-Making Quality (f^2 = 0.263, medium), whereas Service Quality exerts only a small effect on Decision-Making Quality (f^2 = 0.022). This small effect size indicates that, although the Service Quality to Decision-Making Quality path is statistically significant, its practical contribution is limited. Predictive relevance was assessed through the Q^2 values obtained from a blindfolding procedure (construct cross-validated redundancy). As reported in table 4a, the Q^2 values for User Satisfaction (0.396) and Decision-Making Quality (0.383) are well above zero and exceed the 0.35 benchmark, indicating that the model has large predictive relevance for both endogenous constructs.

Table 4b. Effect Sizes (f^2) for the Structural Paths

Structural path			f^2	Effect
IQ	→	USAT	0.377	Large
IQ	→	DMQ	0.263	Medium
SQ	→	DMQ	0.123	Small–medium
USAT	→	DMQ	0.060	Small
SVQ T	→	USAT	0.040	Small
SQ	→	USAT	0.031	Small
SVQ	→	DMQ	0.022	Small

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To further examine the stability of this dominant path, the bootstrapping distribution of the Information Quality to Decision-Making Quality coefficient was inspected, as shown in figure 3. Across the resampled subsamples the coefficient spreads roughly between 0.26 and 0.61 and clusters densely around 0.43, which is very close to the point estimate of 0.429 reported in Table 4. The distribution is approximately bell-shaped and, more importantly, none of the resampled values reach or fall below zero. This indicates that the positive influence of Information Quality on Decision-Making Quality is stable across resamples, consistent with the high t-value of 8.345 obtained for this path; nonetheless, statistical inference is based primarily on the bootstrapped significance test rather than on visual inspection of the distribution. The concentration of the distribution well above zero therefore reinforces the earlier result that the quality of the information produced by the ERP system is the strongest driver of the quality of the decisions its users make.

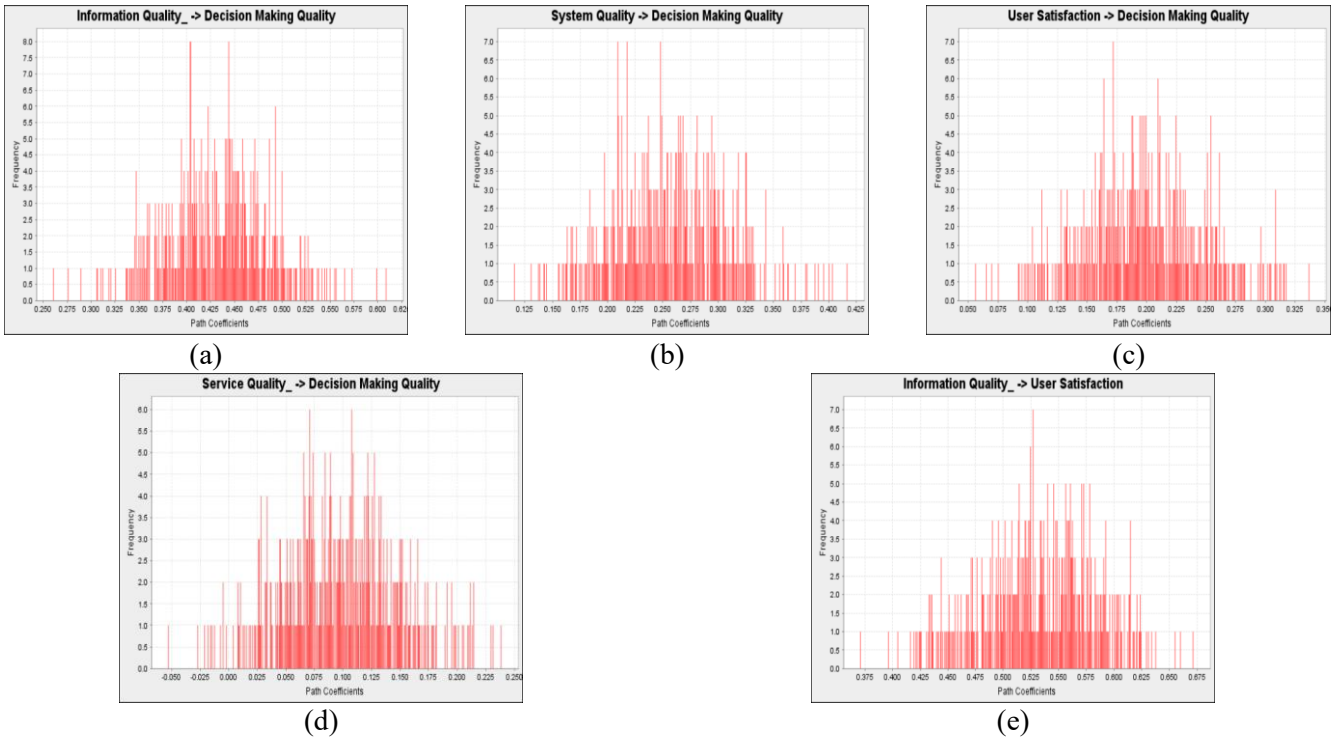


Figure 3. Bootstrapping distributions of the estimated path coefficients: (a) Information Quality → Decision-Making Quality, (b) System Quality → Decision-Making Quality, (c) User Satisfaction → Decision-Making Quality, (d) Service Quality → Decision-Making Quality, and (e) Information Quality → User Satisfaction

Figure 3 presents the bootstrapping distributions of the five estimated path coefficients as panels (a) to (e). In each panel the resampled coefficients cluster around the corresponding point estimate reported in Table 4: approximately 0.43 for Information Quality to Decision-Making Quality (a), 0.25 for System Quality to Decision-Making Quality (b), 0.20 for User Satisfaction to Decision-Making Quality (c), 0.10 for Service Quality to Decision-Making Quality (d), and 0.53 for Information Quality to User Satisfaction (e). For most paths the distributions lie entirely above zero, indicating stable positive effects across the resamples. The exception is Service Quality to Decision-Making Quality (d), whose lower tail approaches and marginally crosses zero, consistent with this being the weakest of the accepted paths ($\beta = 0.102$, $T = 2.090$); the effect is statistically significant but the least robust. Statistical inference is based on the bootstrapped significance tests rather than on visual inspection of these distributions.

A similar pattern is observed in the formation of User Satisfaction, where Information Quality again emerges as the dominant predictor ($\beta = 0.535$, $T = 10.708$), followed by Service Quality ($\beta = 0.163$, $T = 3.906$) and System Quality ($\beta = 0.152$, $T = 2.969$). These findings imply that ERP users in this study evaluate their satisfaction primarily through the quality of the information they receive rather than through the technical characteristics of the system itself. Furthermore, the significant path from User Satisfaction to Decision-Making Quality ($\beta = 0.200$, $T = 4.100$) confirms that satisfaction functions not only as an outcome of the three quality dimensions but also as a channel through which those dimensions contribute to better decision-making. Overall, these results are consistent with the propositions of the

DeLone and McLean IS Success Model and reinforce earlier empirical evidence that ERP quality dimensions improve decision outcomes both directly and through user satisfaction [3], [9].

The results of the indirect effect analysis, which examines the mediating role of ERP User Satisfaction in the relationship between the three quality dimensions and Decision-Making Quality. The specific indirect effects of the three quality dimensions on Decision-Making Quality are reported in table 5.

Table 5. Specific Indirect Effect

Path					ß	T-stat	P Values	Results
IQ	→	USAT	→	DMQ	0.107	3.71	0.000	Accepted
SVQ	→	USAT	→	DMQ	0.033	2.412	0.016	Accepted
SQ	→	USAT	→	DMQ	0.031	2.238	0.026	Accepted

The final test conducted in this research is the specific indirect effect test, which examines whether User Satisfaction mediates the relationship between the three quality dimensions and Decision-Making Quality. This test evaluates the indirect path from each exogenous construct to Decision-Making Quality through User Satisfaction, and a mediating effect is considered significant when the T-statistic exceeds 1.96 and the P value is below 0.05 [23]. The results of this test are presented in the table below.

As shown in table 5, all three indirect paths are significant, confirming that User Satisfaction serves as a mediating variable in this research model. Information Quality has the largest indirect effect on Decision-Making Quality through User Satisfaction (β = 0.107, T = 3.710), followed by Service Quality (β = 0.033, T = 2.412) and System Quality (β = 0.031, T = 2.238). The dominance of Information Quality in both the direct and indirect paths is consistent with recent ERP research emphasizing that the quality of the information produced by the system is the most critical factor shaping how users evaluate and respond to ERP applications [2], and echoes evidence from digital accounting systems showing that information quality drives system utilization and, ultimately, the quality of the decisions produced [18], [19]. Interestingly, this finding also contrasts with a recent study of government information system users in Indonesia in which information quality failed to influence user satisfaction [22], suggesting that in ERP environments, where the system output is consumed directly as a basis for operational and managerial decisions, users are considerably more sensitive to the quality of the information they receive. The bootstrapped confidence intervals and Variance Accounted For (VAF) values for the indirect effects are reported in table 5a.

Table 5a. Bootstrapped Confidence Intervals and VAF for the Specific Indirect Effects

Indirect path					Indirect effect	95% BC CI [2.5%, 97.5%]	VAF	Mediation
IQ	→	USAT	→	DMQ	0.107	[0.059, 0.168]	20.0%	Complementary partial
SVQ	→	USAT	→	DMQ	0.033	[0.013, 0.063]	24.3%	Complementary partial
SQ	→	USAT	→	DMQ	0.031	[0.010, 0.062]	10.7%	Weak / near-absent

To establish the robustness and type of mediation, 95% bias-corrected bootstrapped confidence intervals and the VAF ratio were computed for the three specific indirect effects, as shown in table 5a. None of the confidence intervals include zero, confirming that all three indirect effects are statistically significant. The VAF values indicate complementary partial mediation for the Information Quality (VAF = 20.0%) and Service Quality (VAF = 24.3%) pathways, because their direct and indirect effects share the same positive sign and both remain significant. For the System Quality pathway, however, the VAF of 10.7% falls below the 20% threshold typically used to indicate meaningful mediation, suggesting that User Satisfaction plays only a marginal mediating role in the relationship between System Quality and Decision-Making Quality, even though the indirect effect is statistically significant. These results therefore refine, rather than uniformly support, the earlier conclusion of partial mediation across all three quality dimensions.

Because the direct paths from all three quality dimensions to Decision-Making Quality also remain significant, the mediation is partial rather than full: Information Quality, System Quality, and Service Quality improve decision quality both directly and by first enhancing satisfaction. This is consistent with the intervening role of user satisfaction in earlier ERP studies [3] and with evidence that system and service quality contribute to satisfaction across information

systems [1], [13], [22]. The significant contribution of Service Quality contrasts with studies in which it showed weak effects [19], [26], suggesting the IS/IT function may play a more visible role in the cloud ERP environment examined here. The central position of User Satisfaction aligns with evidence positioning satisfaction as the key conduit through which system qualities become downstream benefits [27], [28].

To summarise, the measurement model, structural model, and indirect effect tests are consistent with each other and offer consistent empirical support for the research model developed in this study. Information Quality is the most important determinant for User Satisfaction and Decision-Making Quality, followed by System Quality and Service Quality. User Satisfaction is a significant partial mediator for all quality dimensions. The results confirm the validity of the DeLone and McLean IS Success Model for explaining decision-making outcomes within the framework of ERP applications [1], [9]. This is in line with recent validations of the model in a variety of information system domains [10], [29] and with emerging evidence from related digital-system contexts that quality dimensions and user satisfaction jointly determine the quality of organisational decision-making [18], [19]. From a practical perspective, organisations seeking to improve the quality of decisions made through their ERP systems should focus on the accuracy, timeliness, and utility of information provided by the system, while maintaining system stability and responsive IS/IT support services [1], [2].

5. Conclusion

This study was conducted to analysis the determinant factors of quality of decision making of ERP applications by examining the effect of Information Quality, System Quality and Service Quality on Decision Making Quality both directly and through the mediating role of User Satisfaction based on the DeLone and McLean IS Success Model. The data were obtained from 399 valid respondents who were ERP users in Batam and analysis using PLS-SEM approach. The measurement model was assessed and all constructs met the required criteria of convergent validity and reliability. The structural model validation indicated support for all seven hypotheses put forward in this research with all paths having a positive and significant relationship.

The results show that Information Quality is the most dominant determinant in the model with the strongest influence on both Decision-Making Quality ($\beta = 0.429$) and User Satisfaction ($\beta = 0.535$), followed by System Quality and Service Quality. The test of the specific indirect effect also showed that User Satisfaction partially mediates the effect of all three quality dimensions on Decision-Making Quality. Thus, the quality attributes of an ERP system impact users' decisions not only directly but also through their satisfaction with the system first. The results support the importance of the DeLone and McLean IS Success Model in the ERP context and extend previous research by showing that the direct paths from the three quality dimensions to decision-making quality are still significant in addition to the mediated paths.

The practical implication of this research is that organizations that want to improve the quality of decisions made through ERP systems should make their highest priority to make sure that the data produced by the system is accurate, timely, easy to understand, and relevant to the work of users. They should also make sure that the system is stable and easy to use, and that the IS/IT support function is responsive. For ERP vendors and implementation teams, these findings suggest that investments in data governance and information presentation are more likely to lead to better decision outcomes than investments in technical features alone.

There are some limitations that provide opportunities for future research. First, the discriminant validity between Information Quality and Decision-Making Quality is a key limitation. This concerns the separation between the two constructs, not their individual quality: convergent validity and reliability were satisfactory, with every AVE above 0.50. Under the Fornell-Larcker criterion, the square root of the AVE serves as the benchmark for inter-construct correlations; here the square root of the AVE of Decision-Making Quality (0.753) and of Information Quality (0.728) is only marginally higher than their correlation (0.771), and the HTMT ratio between them is 0.996, above the 0.90 and 0.85 thresholds. The issue therefore lies in the empirical overlap between the two constructs rather than in the adequacy of either one. A likely cause is conceptual proximity in the items, as several Information Quality indicators refer to the usefulness of ERP information for decision-making and overlap with the Decision-Making Quality scale; consequently, part of the strong estimated relationship may reflect this overlap rather than a fully independent effect,

and the corresponding results are interpreted with caution. Future research should refine and re-validate the two constructs with more clearly differentiated indicators and re-estimate the model. Second, the study used a single geographical area and a cross-sectional design, limiting generalizability; future work may broaden coverage, adopt a longitudinal design, or compare ERP platforms. Third, incorporating variables such as system usage, top management support, or user competence could more fully explain decision-making quality in ERP environments.

Beyond these, several further limitations apply. Fourth, because the data are self-reported and single-source at one point in time, common method bias is possible; procedural remedies were applied during questionnaire design, and a statistical assessment alongside future multi-source or time-lagged data is recommended. Fifth, the User Satisfaction scale includes items referencing satisfaction with information and service quality; this proximity to the exogenous dimensions may inflate the observed relationships, and future work should use a satisfaction measure capturing overall affective evaluation independently of specific quality dimensions. Sixth, Decision-Making Quality was measured perceptually; future studies should validate it against external criteria such as decision turnaround time, error rates, or supervisor evaluations. Seventh, the study did not control for deployment model, ERP vendor, or functional module; adding these as controls and applying multi-group analysis would show whether the relationships hold across contexts. Finally, given the cross-sectional, correlational design, the relationships should be read as statistical associations consistent with the hypothesized model rather than confirmed causal effects.

6. Declarations

6.1. Author Contributions

Conceptualization: M.D.F., Z.S., and N.I.M.S.; Methodology: M.D.F.; Software: M.D.F.; Validation: M.D.F., Z.S., and N.I.M.S.; Formal Analysis: M.D.F.; Investigation: M.D.F. and W.J.K.; Resources: M.D.F. and E.; Data Curation: M.D.F.; Writing Original Draft Preparation: M.D.F.; Writing Review and Editing: M.D.F., W.J.K., E., Z.S., and N.I.M.S.; Visualization: M.D.F.; All authors have read and agreed to the published version of the manuscript.

6.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

6.3. Funding

This research was funded by the Faculty of Information and Communication Technology (FTMK), University of Teknikal Malaysia Melaka (UTeM), Malaysia. The funding body had no role in the design of the study, data collection, analysis, interpretation of data, or in writing the manuscript.

6.4. Institutional Review Board Statement

Not applicable.

6.5. Informed Consent Statement

Not applicable.

6.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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