Analysis of Factors Affecting ERP Implementation Performance Using the Analytical Hierarchy Process (AHP): A Case Study at PT Multi Makmur Investama (Multives) Tangerang

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***Abstract*— The Indonesian packaging industry faces mounting pressure to align enterprise systems with evolving strategic and operational demands. This study investigates the performance of a mature Enterprise Resource Planning (ERP) system at PT Multi Makmur Investama (Multives), leveraging the Critical Success Factors (CSF) framework and Analytic Hierarchy Process (AHP) to identify and prioritize key determinants of ERP success. Ten CSFs were evaluated through expert pairwise comparisons and cross-validated via a perception survey of 51 ERP users. Results reveal ERP system quality (18.16%), top management support (14.19%), and user training (10.79%) as the most influential drivers. However, notable discrepancies emerged between expert prioritization and user satisfaction particularly in vendor support and training indicating underlying misalignments in long-term ERP usage. The study contributes a dual-layered evaluation model combining structured expert judgment and user-based validation, offering actionable insights for ERP optimization in emerging market contexts and extending theoretical discourse on ERP maturity evaluation.**

***Index Terms*— Analytic Hierarchy Process (AHP), Critical Success Factors (CSF), Decision Analysis, ERP Maturity, ERP Performance, Indonesian Manufacturing, User Perception.**

I. INTRODUCTION

In Indonesia's manufacturing sector, the packaging industry plays a crucial role in supporting supply chains, particularly in food, pharmaceuticals, and consumer goods. Increasing market demands for speed, customization, and traceability have exposed operational inefficiencies in many local firms, driven companies to seek technological solutions that can enhance internal coordination and responsiveness. One such solution is the adoption of Enterprise Resource Planning (ERP) systems, which offer integrated platforms to manage resources, streamline workflows, and enable real-time decision-making [1] [2] [3]

ERP systems are inherently technology based and require robust IT infrastructure including centralized databases, scalable networks, and customizable software to function effectively [4]. Beyond technical infrastructure, ERP success also hinges on organizational factors such as user readiness, leadership commitment, and training quality [5]. As highlighted by [6], ERP implementation must be understood not only as a technology project but also as a process of organizational transformation.

Despite the strategic promise, many ERP projects underdeliver. Studies report that over 70% of ERP implementations globally fail to meet their intended goals, often due to poor alignment with organizational needs or lack of stakeholder engagement [7]. This issue is particularly relevant for resource-constrained and mid-sized manufacturing firms in Indonesia, where post-implementation evaluations are infrequent. As noted by Silitonga (2023), periodic reviews of ERP systems are essential to ensure continued alignment with changing business objectives and to identify areas where system performance may no longer meet organizational needs.[8]

PT Multi Makmur Investama (Multives), a packaging manufacturer located in Tangerang, implemented the CPS/Enterprise ERP system in 2013. While the system remains operational, ongoing issues persist, such as siloed data across departments, dependency on vendors for system adjustments, and limitations in real-time reporting. These issues reflect broader challenges in mature ERP systems that have not undergone continuous performance evaluation.

To address the challenges, organizations must identify and prioritize the most critical success factors (CSFs) that influence ERP effectiveness. The CSF framework has been widely adopted to examine key determinants such as system quality, user training, management support, vendor responsiveness, and IT infrastructure [9] [10]. While the factors have been explored in initial ERP adoption contexts, their prioritization in long-standing implementations remains underexplored.

This study applies the Analytical Hierarchy Process (AHP) to evaluate the relative importance of ERP success factors at Multives, integrating expert judgment with structured decision analysis. AHP was selected for its ability to quantify subjective assessments, ensure consistency in multi-criteria decisions, and generate prioritized outputs in complex decision environments [11]. Compared to other methods such as TOPSIS or fuzzy logic, AHP is particularly effective when expert consensus is limited yet required for strategic prioritization [12].

The study incorporates ERP user feedback to compare strategic priorities against real-world perceptions, aiming to uncover critical gaps that may hinder system performance. This dual approach combining managerial insights and user evaluations offers both theoretical and practical contributions to ERP implementation research, especially in mature systems operating in emerging-market contexts.

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II. LITERATURE REVIEW

A. *ERP Success and the Role of Critical Success Factors (CSFs)*

The success of ERP implementation has been extensively studied using various theoretical frameworks, with the DeLone and McLean Information Systems Success Model being one of the most widely acknowledged. This model provides a comprehensive approach by identifying six interrelated dimensions system quality, information quality, use, user satisfaction, individual impact, and organizational impact, which continue to serve as a foundational basis for ERP evaluation research [5]. Six dimensions encompass both technical and human elements essential for evaluating the effectiveness of ERP systems, making it an invaluable tool for understanding ERP success within organizational contexts. The DeLone and McLean Information Systems Success Model diagram is shown in Fig. 1. Despite the widespread acceptance of this model, there remain gaps in the literature concerning its application in mature organizations, particularly in understanding the discrepancies between strategic expectations and operational realities.

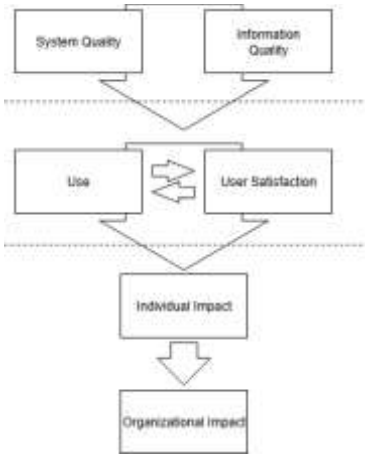


Fig. 1 DeLone and McLean Information Systems Success Model diagram

From a technical standpoint, ERP is inseparable from the underlying IT infrastructure. As emphasized by Davenport (1998) and Monk & Wagner (2012), ERP is not merely a managerial tool but a comprehensive digital system that relies on integrated infrastructure, servers, software platforms, and network connectivity to ensure data centralization, process automation, and seamless workflows across departments Fig.2. Without robust IT infrastructure and standardized digital platforms, ERP cannot function effectively. This foundational concept of ERP is essential. The application often requires adaptation to the more complex operational dynamics of long-established organizations.[4] [2]

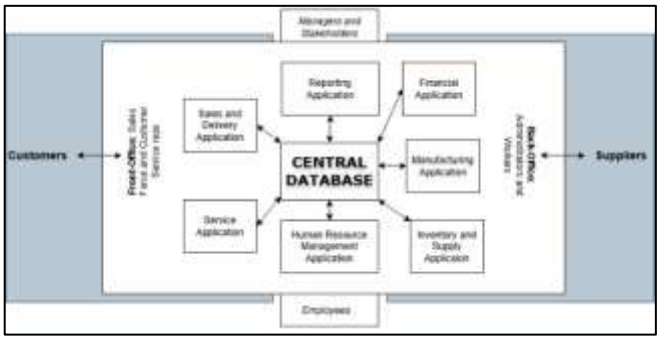


Fig. 2 Basic ERP Concept

Rockart's (1979) concept of Critical Success Factors (CSFs) further extends this by identifying essential conditions that must be met for successful ERP implementation. CSFs bridge the technical and organizational domains, highlighting that system quality, technological readiness, user training, executive support, and change management must coexist to drive ERP success [13] [12]. Contemporary studies have clustered these factors into two domains, the ERP System Environment and the Organizational Environment [14], providing a practical structure for strategic analysis. This two-dimensional CSF framework is widely accepted, many existing studies remain descriptive, offering limited insights into the interactions between these factors within the context of more mature organizations.

Mas'iffah (2018) identifies several key factors, such as system quality and vendor support, but fails to prioritize or validate these elements within the context of ERP implementation. This omission restricts the strategic guidance provided, particularly for organizations that have been using ERP systems for extended periods yet continue to experience a misalignment between system capabilities and their business objectives. Few studies have integrated both managerial insights and user-level feedback to validate the strategic assumptions that underpin the Critical Success Factors (CSFs) [10].

To address gap, this study offers a differentiated approach, it evaluates ERP in the context of a mature system that has been operational for over 10 years and incorporates both expert judgment and user feedback. This approach allows us to examine potential misalignments between strategic expectations and operational realities, as well as uncover new factors that contribute to a deeper understanding of ERP success in more complex organizational environments.

B. *Application of the Analytical Hierarchy Process (AHP) in ERP Evaluation*

The Analytical Hierarchy Process (AHP), developed by Saaty (1980), is a well-established multi-criteria decision-making method that decomposes complex problems into a structured hierarchy of decision factors. By utilizing pairwise comparisons, AHP captures expert preferences and quantifies the relative importance of various decision criteria. The method's built-in Consistency Ratio (CR) ensures the logical coherence of these preferences by assessing the internal consistency of judgment matrices (Saaty, 2002) [15].

In the context of ERP research, AHP has been widely applied to prioritize success factors in ERP implementation [16], vendor selection [17], and decisions regarding system customization. The majority of these applications have focused on the early stages of ERP implementation, such as pre-implementation planning and vendor selection, rather than post-implementation assessment. Moreover, a significant gap in existing literature is the predominant reliance on expert opinions without integrating user perspectives. This oversight can potentially neglect the practical challenges and issues encountered during day-to-day ERP operations.

This study extends the application of the Analytical Hierarchy Process (AHP) by utilizing it within the context of a mature ERP system that has been operational for over a decade. Furthermore, the strategic prioritization of Critical Success Factors (CSFs) is validated using perception data obtained from system users. This integrated approach offers a more comprehensive evaluation of ERP effectiveness, providing a deeper understanding of how AHP can support

long-term ERP adaptation strategies, particularly within the manufacturing sector. The research contributes to the methodological advancement of ERP studies by addressing a significant gap in current AHP applications, ensuring the incorporation of both managerial insights and user feedback to enhance decision-making processes.

C. Critical Success Factors (CSF) in ERP Implementation

Critical Success Factors (CSFs) are fundamental managerial and technical levers that must be effectively addressed for successful ERP adoption [18] [19]. Aini et al. (2020) emphasize that CSFs span across organizational design, technical integration, and process management. Table 1 provides a summary of the CSFs commonly identified in ERP research, categorized into two domains, the ERP System Environment and the Organizational Environment. These factors, which include technology infrastructure, system quality, vendor support, and user training, are critical in ensuring the effective implementation and sustainability of ERP systems.

However, while this classification helps streamline strategic focus, few studies investigate whether the relative importance of these CSFs remains consistent in long-standing ERP environments. Organizations undergo continuous evolution in terms of business models, market challenges, and technological advancements, leading to the possibility that certain success factors may either gain or lose significance over time. Therefore, simply identifying CSFs is not sufficient, it is essential to prioritize and validate through empirical evidence to reflect real-world dynamics. Prioritization based on expert judgment, combined with user feedback, provides a more nuanced understanding of how these factors influence ERP success over the long term. This paper addresses this gap by integrating both expert and user perspectives, thus contributing to a more comprehensive and context-sensitive approach to ERP evaluation.

TABLE I.
ERP IMPLEMENTATION CSF (CRITICAL SUCCESS FACTORS) [9]

No.	Category	CSF
1	ERP System Environment	Technology Infrastructure
2		ERP System Quality
3		Vendor Support
4		Consultant Utilization
5		Software Analysis, Testing, and Troubleshooting
6		Appropriate ERP Software Selection
7	Organizational Environment	User Training
8		User Involvement
9		Management Support
10		Communication and Collaboration Across Organization
11		Clear Implementation Goals
12		Project Management
13		Change Management
14		Project Team Competence
15		Project Leader

D. Identified Research Gap

Despite the extensive body of ERP research, three critical gaps remain:

1. Lack of ERP Maturity Studies: Although significant research has been dedicated to the early stages of ERP implementation, a notable gap exists in the literature concerning ERP systems that have been operational for over a decade. These long-standing systems often encounter substantial challenges as they strive to adapt to evolving strategic directions and changing organizational needs. Despite their prolonged use, these systems remain underexplored in existing studies, particularly in terms of their ability to evolve and sustain long-term effectiveness. This gap in research obstructs a comprehensive understanding of how ERP systems mature over time and their continued relevance in mature organizational environments. While existing maturity models, such as those proposed by Somers and Nelson (2001), provide valuable insights into ERP system development, there is an urgent need for more empirical studies that specifically address ERP systems in mature organizational settings. Such studies are critical for advancing the understanding of ERP evolution, particularly as these systems continue to adapt and align with dynamic business strategies in established companies [20].
2. Limited Triangulation Between Expert and User Insights: ERP implementation strategies are frequently based on managerial assumptions, with limited integration of user feedback. This one-sided approach can lead to a disconnect between strategic decisions and the actual usability and satisfaction experienced by users at the operational level. The failure to triangulate expert insights with user perspectives hinders a more accurate assessment of ERP system performance, particularly in the context of long-term adaptation.
3. Underutilization of AHP for Post-Implementation Evaluation: Although the Analytical Hierarchy Process (AHP) is a well-established tool for prioritizing ERP success factors during the planning and implementation stages, its application in post-implementation evaluation remains scarce. The potential of AHP to validate system performance in live ERP environments, particularly in mature systems, is underexplored.

This study seeks to address these gaps by integrating the Critical Success Factor (CSF) framework with AHP prioritization and validating these priorities with perception data from users across various departments in PT Multives, a packaging manufacturer with over 10 years of ERP experience. This dual-validation mechanism not only enhances the theoretical depth of ERP-CSF research, particularly in mature system environments, but also offers practical insights for organizations seeking to optimize their ERP systems. Theoretically, this study contributes to the understanding of ERP evolution, extending existing research to focus on mature ERP systems. Methodologically, it introduces a dual-validation approach that combines expert judgment with user feedback, offering a more comprehensive perspective on ERP effectiveness. This approach is particularly valuable for organizations in emerging markets, where ERP adaptation remains an ongoing challenge [1]

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III. Material and Methods

A. Research Setting

The research was conducted at PT Multi Makmur Investama (Multives), a holding company overseeing four strategic business units in the packaging industry, based in Tangerang. Multives focuses on providing high-quality, flexible, and timely packaging solutions. The study included two subsidiaries with implemented ERP systems: PT Multibox Indah in Cikande, Banten, with a production capacity of 7,000 tons per month, and PT Karya Indah Multiguna in Bantar Gebang, Bekasi, producing 10,000 tons per month. Both units specialize in paper-based packaging, including corrugated boxes. Multives emphasizes innovation and efficiency, holding certifications such as ISO 9001:2008 and FSC COC from TUV Rheinland.

B. Research Design and Model

This study adopts a quantitative descriptive methodology to investigate the Critical Success Factors (CSFs) influencing ERP system implementation at PT Multi Makmur Investama (Multives). The research aimed to identify key CSFs, prioritize them using the Analytic Hierarchy Process (AHP), and assess the performance of the current ERP implementation from the perspective of end-users, using structured questionnaires.

The research framework integrates three core components:

- Identification of CSFs
- Prioritization using AHP
- Performance evaluation through Likert-scale metrics

The study focuses on both technical and organizational dimensions affecting ERP implementation, such as system quality, user training, top management support, and vendor involvement, as supported by the literature on ERP success factors [13]. While these factors are commonly discussed in ERP studies, the integration of AHP with user-based evaluations of ERP performance in a mature system context adds a novel dimension to the current body of knowledge.

The AHP method, developed by Saaty (1980), was employed to structure the decision-making process hierarchically and derive priority weights through pairwise comparisons. This technique is particularly suitable for decision-making scenarios with a limited set of criteria that require judgment-based inputs. The effectiveness of AHP has been demonstrated in previous ERP studies, such as those by [16] and [17], who effectively applied AHP in multi-criteria decision-making environments.

A structured questionnaire was distributed to ERP users at Multives, containing both AHP pairwise comparison matrices and Likert-scale items to capture user evaluations of the ERP system's performance. This integrated approach enabled a comprehensive assessment, combining both the prioritization of success factors and user-based performance evaluation, reflecting the operational realities of ERP adoption within the company.

C. Participants and Sampling

This study involved two respondent groups:

1. Expert Group: ERP project managers, IT heads, and internal consultants with strategic and technical experience in ERP implementation. These experts were tasked with identifying and validating the CSFs and completing the pairwise comparison questionnaires based on the AHP methodology.

   Expert respondents were selected based on a minimum of four years of ERP experience or participation in at least one full implementation cycle. This criterion aligns with Saaty's (1980) AHP principle, which emphasizes depth of expertise over sample size. Such experience ensures reliable pairwise judgments grounded in both technical and operational understanding. Previous studies [20] also support four years as sufficient for developing insight into ERP-related decision-making.
2. The expert sample size of seven (n = 7) is methodologically justified for the AHP approach. AHP prioritizes the depth of judgment over sample volume (Saaty, 2002). Previous ERP research, including studies by [13] has demonstrated that small expert panels, typically ranging from five to ten participants, are sufficient, provided the participants possess substantial knowledge and diverse expertise. In this study, the seven experts offer a broad spectrum of insights, encompassing strategic, technical, and operational perspectives on ERP implementation. Therefore, the expert panel's size is adequate to ensure the validity and robustness of the AHP results.
3. ERP User Group (n = 51): ERP users from various departments (finance, logistics, marketing, production, and human resources) were selected using stratified random sampling. This selection ensures that the feedback gathered accurately represents a diverse set of user experiences, increasing the reliability of the performance evaluation.

D. Data Collection Procedures

Data were collected using structured questionnaires distributed to both expert and user groups:

Expert Respondents (n = 7): These respondents were selected using purposive sampling, based on their involvement in ERP strategic planning and implementation. Their role was to complete the AHP pairwise comparison matrices, a core aspect of the study methodology. The small sample size aligns with AHP's preference for depth rather than volume, which has been demonstrated as effective in similar studies.

ERP Users (n = 51): The user group was selected through stratified random sampling, ensuring a broad representation across various departments. They completed a Likert-scale questionnaire assessing ERP performance, which helped validate AHP results.

The data collection followed a four-stage process:

- Literature review and factor identification
- Expert AHP evaluation
- User perception survey
- Data synthesis and analysis using Excel and SuperDecisions software.

E. Analytical Hierarchy Process (AHP) Steps

The AHP method was used to prioritize the identified CSFs by collecting expert judgments via pairwise comparisons. The AHP process is suitable for studies like this, where a limited set of decision criteria is involved, and expert input is crucial for determining the priority of factors.

Key steps in the AHP methodology include:

- Hierarchy Structuring: Identifying the main factors that influence ERP implementation success.
- Pairwise Comparison Development: Distributing pairwise comparison questionnaires to expert respondents to evaluate the relative importance of each factor.

- Matrix Construction: Constructing pairwise comparison matrices based on expert responses.
- Weight Calculation: Using the geometric mean method to calculate the priority weights of the CSFs.
- Consistency Check: Ensuring the reliability of the judgment by checking the consistency ratio (CR ≤ 10%).

This method, as demonstrated in ERP research by Chan & Kumar (2007) and Kabir & Sumi (2012), has proven effective in single-case, multi-criteria decision-making environments and is particularly valuable when expert judgment is integral to the decision-making process.

F. ERP Performance Measurement

After determining the priority weights of CSFs through AHP, a gap analysis was conducted comparing the AHP-derived priorities with user-perceived ERP performance. This analysis identified high-priority factors with low user satisfaction, serving as the foundation for improvement recommendations.

G. Data Analysis Tools

AHP Results: Analyzed using SuperDecisions software, which helped determine priority rankings of the CSFs. The consistency of pairwise comparisons was manually validated using Microsoft Excel.

Performance Data: Analyzed using descriptive statistics (mean and standard deviation) to assess ERP performance and identify areas for improvement.

H. Methodological Limitations

Despite the effectiveness of the Analytical Hierarchy Process (AHP), its reliance on subjective judgment from a small expert panel may introduce bias. However, the seven experts in this study, each with over 4 years of ERP experience or involvement in at least one full implementation cycle, provide sufficient depth of expertise. AHP emphasizes the quality of judgment over the number of participants (Saaty, 2002), and the experts' comprehensive understanding ensures the validity of the results in real-world ERP contexts.

While the case study design offers detailed insights into Multives' ERP system, it limits the generalizability of the findings. Future research could broaden the expert panel and incorporate mixed-method approaches to validate results across different organizational settings, enhancing the robustness and applicability of the conclusions.

I. Ethical Considerations.

All participants were informed about the purpose of the study and their role in the data collection process. Participation was voluntary, and confidentiality of responses was ensured. The research adhered to ethical standards for human subject's research and obtained prior verbal consent from all respondents

IV. RESULTS

A. Selection of Critical Success Factors (CSFs)

The identification of Critical Success Factors (CSFs) for ERP implementation was based on a comprehensive synthesis of prior ERP success studies (Shatat and Dana shata2016) [14] [6] further validated through expert interviews at PT Multives. The CSFs were categorized into two primary groups: ERP System Environment and Organizational Environment, addressing both the technical and managerial dimensions of ERP success [5]. While the CSF selection table primarily draws from local references, international literature has been incorporated to further solidify the study's theoretical framework [20] [21] [9]. The integration of international sources with local references ensures that this study is anchored in globally recognized frameworks while maintaining contextual relevance to the ERP implementation at PT Multives.

This classification aligns with existing ERP success literature, emphasizing its multifaceted nature. However, this study contributes by applying these dimensions to a mature ERP system that has been operational for over a decade, an area underexplored in current research. By focusing on both technical infrastructure and organizational processes, this study captures the evolving nature of ERP systems in mature settings. Table 2 and table 3 shows the selection of CSF criteria in the Organizational Environment category and ERP System Environment.

TABLE II.
SELECTION OF CSF CRITERIA IN THE ORGANIZATIONAL ENVIRONMENT CATEGORY

Source	UT	UI	TMS	IC	CO	PM	BPR	PTC
Kusumawardhana et al. (2024)			√				√	√
Ramdan & Padmakusumah (2025)	√	√	√		√			
Shatat (2019)	√	√	√		√		√	√
PT Multi Makmur Investama (Multives)	√		√		√		√	√
Total	**3**	**2**	**4**	**0**	**3**	**0**	**3**	**3**

UT : User Training
UI : User Involvement
TMS : Top Management Support
IC : Internal Communication
CO : Clear Objectives
PM : Project Management
BPR : Business Process Reengineering
PTC : Project Team Competence

TABLE III.
SELECTION OF CSF CRITERIA IN THE ERP SYSTEM ENVIRONMENT CATEGORY

Source	ITI	ERP SQ	VS	STT	ERP SA	CS
Kusumawardhana et al. (2024)	√	√	√	√	√	√
Ramdan & Padmakusumah (2025)	√	√	√	√	√	√
Shatat (2019)	√	√	√	√	√	√
PT Multi Makmur Investama (Multives)	√	√	√	√	√	
Total	**4**	**4**	**4**	**4**	**4**	**3**

ITI : IT Infrastructure
ERP SQ : ERP System Quality
VS : Vendor Support
STT : Software Testing and Troubleshooting
ERP SA : ERP Software Appropriateness
CS : Consultant Usage

Based on the consensus from literature and expert judgment, ten CSFs were finalized, detail on Table 4, five in each category. This classification aligns with prior research on ERP performance measurement [13]

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TABLE IV.
LIST OF CRITICAL SUCCESS FACTORS (CSFS) USED IN THE PAIRWISE COMPARISON QUESTIONNAIRE

No	CSF Category	Critical Success Factor
1	ERP System Environment	IT Infrastructure
2		ERP System Quality
3		Vendor Support
4		Software Testing and Troubleshooting
5		ERP Software Appropriateness
6	Organizational Environment	User Training
7		Top Management Support
8		Business Process Reengineering
9		Project Team Competence
10		Clear Objectives

B. AHP Hierarchical Structure and Pairwise Comparison Results

The Analytic Hierarchy Process (AHP) model was constructed in accordance with Saaty's (1980) multi-criteria decision-making methodology to systematically assess the relative importance of the Critical Success Factors (CSFs) influencing ERP performance at PT Multi Makmur Investama (Multives). At the highest level of the hierarchy, the primary objective is to identify the most critical factors contributing to the success of ERP implementation.

The second level of the hierarchy includes two consolidated dimensions: ERP System Environment and Organizational Environment, which represent the technical and non-technical aspects, respectively. This bifurcation facilitates a comparative analysis of infrastructural readiness and managerial and human-related factors, thereby reflecting a comprehensive paradigm for ERP success.

At the third level, five CSFs are assigned to each dimension, yielding a total of ten evaluation criteria. These hierarchical levels were operationalized through three structured pairwise comparison matrices: one to evaluate the relative weight between the two primary categories, and two others to prioritize factors within each group. This methodology ensures a balanced evaluation of both technological infrastructure and organizational enablers, offering a well-rounded analysis of ERP implementation outcomes

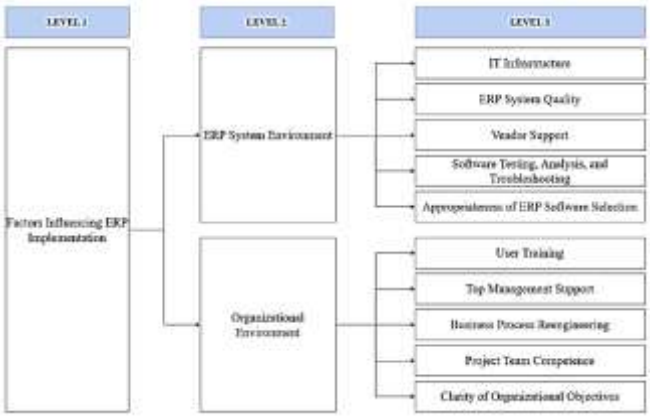


Fig. 3 Hierarchical Structure Diagram of AHP Method Criteria

C. Pairwise Comparison Matrix between Main Categories

Using the Analytic Hierarchy Process (AHP) methodology, experts conducted pairwise comparisons between the two primary Critical Success Factor (CSF) categories: ERP System Environment and Organizational Environment. The pairwise comparison matrix was designed to evaluate the relative importance of these categories in influencing ERP performance at PT Multi Makmur Investama (Multives).

The results of these comparisons are presented in Table 5, where the geometric mean was used to calculate the relative weight between the categories. As seen in the table, the ERP System Environment is slightly more influential than the Organizational Environment, with a ratio of 1.17:1, reflecting the relative importance of the technical infrastructure compared to the organizational capabilities necessary for successful ERP implementation. This methodical comparison ensures that both technical and managerial factors are adequately considered, offering a balanced evaluation of ERP implementation factors.

TABLE V.
PAIRWISE COMPARISON RESULT (GEOMETRIC MEAN)

Category	ERP System Environment	Organizational Environment
ERP System Environment	1	1.17
Organizational Environment	0.8547	1

D. Pairwise Comparison of Sub-Criteria

Following the category-level comparison, pairwise comparisons were conducted for the sub-criteria (CSFs) within each main category ERP System Environment and Organizational Environment. To ensure consistency and reduce individual bias, the geometric mean method was applied to aggregate judgments from seven expert respondents for each sub-criteria matrix. This method is widely accepted in AHP studies to derive a representative group judgment while preserving the multiplicative properties of the pairwise comparison scale [11]

The resulting matrices provide a detailed view of how experts perceived the relative importance of specific technical and organizational success factors in the ERP context. Tables 6 and table 7 present the consolidated geometric mean values for each sub-category.

TABLE VI.
PAIRWISE COMPARISON MATRIX FOR ERP SYSTEM ENVIRONMENT SUB-CRITERIA (GEOMETRIC MEAN AGGREGATION)

Sub-Criteria Comparison	R1	R2	R3	R4	R5	R6	R7	GM
IT Infrastructure vs ERP System Quality	1	7	0.33	1	1	0.33	1	**0.9647**
IT Infrastructure vs Vendor Support	1	0.33	5	3	0.11	1	1	**0.9195**
IT Infrastructure vs Software Testing & Troubleshooting	0.2	0.11	0.33	0.33	1	0.33	1	**0.3625**
IT Infrastructure vs ERP Software Appropriateness	0.11	0.2	0.33	0.2	0.11	0.2	1	**0.2289**
ERP System Quality vs Vendor Support	0.33	9	3	3	1	1	1	**1.6013**
ERP System Quality vs Software Testing & Troubleshooting	1	1	3	0.2	3	3	7	**1.6802**
ERP System Quality vs ERP	9	1	1	0.2	1	5	1	**1.3687**

Sub-Criteria Comparison	R1	R2	R3	R4	R5	R6	R7	GM
Software Appropriateness								
Vendor Support vs Software Testing & Troubleshooting	1	0.11	1	5	0.33	0.33	1	**0.6718**
Vendor Support vs ERP Software Appropriateness	1	7	0.33	5	0.33	0.33	1	**1.0378**
Software Testing & Troubleshooting vs ERP Software Appropriateness	5	1	0.33	0.2	0.33	1	0.33	**0.6245**

TABLE VII.
PAIRWISE COMPARISON MATRIX FOR ORGANIZATIONAL ENVIRONMENT SUB-CRITERIA (GEOMETRIC MEAN AGGREGATION)

Sub-Criteria Comparison	R1[a]	R2	R3	R4	R5	R6	R7	GM
User Training vs Top Management Support	1	7	3	0.2	1	0.2	3	**1.141**
User Training vs Business Process Reengineering	5	0.3	3	3	1	1	0.3	**1.259**
User Training vs Project Team Competence	3	0.1	1	3	3	1	0.1	**0.886**
User Training vs Clear Implementation Objectives	0.1	0.1	1	1	0.2	0.3	1	**0.363**
Top Management Support vs Business Process Reengineering	9	9	1	7	3	3	1	**3.386**
Top Management Support vs Project Team Competence	1	1	0.3	9	0.3	3	1	**1.17**
Top Management Support vs Clear Implementation Objectives	3	1	1	1	0.3	1	1	**1**
Business Process Reengineering vs Project Team Competence	3	0.1	1	0.3	0.3	0.3	0.3	**0.473**
Business Process Reengineering vs Clear Implementation Objectives	0.2	0.1	1	0.3	0.1	0.3	0.3	**0.265**
Project Team Competence vs Clear Implementation Objectives	0.2	0.1	3	1	0.3	0.3	0.3	**0.424**

[a]R=Respondent

The matrix represents pairwise comparisons among the five sub-criteria. The Geometric Mean method was used to synthesize expert judgments, minimizing individual bias and reflecting group consensus.

E. Geometric Mean Aggregated Matrix – ERP System Environment

Table 8 presents the aggregated reciprocal matrix for the ERP System Environment sub-criteria. ERP System Quality (ISQ) emerges as the most important sub-criterion, surpassing ERP Software Appropriateness (ESA) (1.369) and Software Testing and Troubleshooting (STT) (1.68), highlighting its crucial role in ERP performance [5]

The matrix shows moderate influence from IT Infrastructure (IT Infra) and Vendor Support (VS), confirming the interdependent nature of these factors in ERP success.

TABLE VIII.
AGGREGATED RECIPROCAL MATRIX – ERP SYSTEM ENVIRONMENT

Sub-Criteria[a]	IT Infra	ISQ	VS	STT	ESA
IT Infra	1	0.965	0.9195	0.363	0.229
ISQ	1.0366	1	1.6013	1.68	1.369
VS	1.0876	0.625	1	0.672	1.038
STT	2.7584	0.595	1.4886	1	0.625
ESA	4.3688	0.731	0.9636	1.601	1
Total	**10.251**	**3.915**	**5.973**	**5.316**	**4.26**

[a]**Sub-Criteria:**
ISQ: ERP System Quality
VS: Vendor Support
STT: Software Testing & Troubleshooting
ESA: ERP Software Appropriateness

Table 9 displays the aggregated reciprocal matrix for the Organizational Environment sub-criteria, derived from expert responses using geometric mean values. Clear Implementation Objectives (CIO) is the most dominant factor, with consistently high values compared to other criteria, emphasizing its critical role in aligning and ensuring successful ERP implementation. The matrix totals were used to normalize the values and determine priority weights for each sub-factor, reinforcing the importance of strategic clarity in ERP success.

TABLE IX.
AGGREGATED RECIPROCAL MATRIX – ORGANIZATIONAL ENVIRONMENT

Sub-Criteria[a]	UT	TMS	BPR	PTC	CIO
UT	1	1.1412	1.2585	0.886	0.3625
TMS	0.8763	1	3.386	1.1699	1
BPR	0.7946	0.2953	1	0.4729	0.2649
PTC	1.1287	0.8548	2.1145	1	0.4241
CIO	2.7584	1	3.7755	2.3577	1
Total	**6.558**	**4.2912**	**11.5345**	**5.8866**	**3.0515**

[a]**Sub-Criteria:**
UT: User Training
TMS: Top Management Support
BPR: Business Process Reengineering
PTC: Project Team Competence
CIO: Clear Implementation Objectives

F. Normalized Matrix and Priority Weights

1) Main Categories

Following the matrix, in the table 10 values were normalized to calculate the priority weights for main categories. The ERP System Environment was assigned a weight of 53.90%, while the Organizational Environment received 46.10%, confirming a moderate preference for technical system factors in ERP success.

TABLE X.
NORMALIZED MATRIX AND PRIORITY WEIGHTS

Category	ERP System (Normalized)	Org. Environment (Normalized)	Priority Weight (%)
ERP System Environment	0.539	0.539	**53.90%**
Organizational Environment	0.461	0.461	**46.10%**

2) Sub-Criteria

Table 11 shows the normalized decision matrix for the ERP System Environment sub-criteria. Each element in the matrix was obtained by dividing the values in the aggregated reciprocal matrix by the corresponding column total. This

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normalization ensures that the sum of each column equals one (Saaty, 1980).

The local priority weights presented in the 'Eigen' column were calculated by averaging the values in each row. These weights reflect the relative importance of each technical factor influencing ERP implementation, based on expert judgment.

TABLE XI.
NORMALIZED MATRIX AND LOCAL WEIGHTS – ERP SYSTEM ENVIRONMENT

Sub-Criteria[a]	IT	ISQ	VS	ST	ESA	Eigen
IT	0.0975	0.2464	0.1539	0.0682	0.0537	**0.124**
ISQ	0.1011	0.2554	0.2681	0.3161	0.3213	**0.2524**
VS	0.1061	0.1595	0.1674	0.1264	0.2436	**0.1606**
ST	0.2691	0.152	0.2492	0.1881	0.1466	**0.201**
ESA	0.4262	0.1866	0.1613	0.3012	0.2347	**0.262**

[a]**Sub-Criteria:**
IT = IT Infrastructure
ISQ = ERP System Quality
VS = Vendor Support
ST = Software Testing & Troubleshooting
ESA = ERP Software Appropriateness
Eigen = Local Priority Weight (Average per row)

Table 12 presents the normalized decision matrix for the Organizational Environment sub-criteria. The values were obtained by dividing each element by its respective column total, and the local weights (eigen values) were derived from averaging each row. The results show that Clear Implementation Objectives (0.3418) is perceived as the most influential organizational factor, emphasizing the importance of goal clarity in ERP execution. Conversely, Business Process Reengineering (0.0888) is rated lowest, suggesting that it plays a more limited role in this case.

TABLE XII.
NORMALIZED MATRIX AND LOCAL WEIGHTS – ORGANIZATIONAL ENVIRONMENT

Sub-Criteria[a]	UT	TMS	BPR	PTC	CIO	Eigen
UT	0.1525	0.2659	0.1091	0.1505	0.1188	**0.1594**
TMS	0.1336	0.233	0.2936	0.1987	0.3277	**0.2373**
BPR	0.1212	0.0688	0.0867	0.0803	0.0868	**0.0888**
PTC	0.1721	0.1992	0.1833	0.1699	0.139	**0.1727**
CIO	0.4206	0.233	0.3273	0.4005	0.3277	**0.3418**

[a]**Sub-Criteria:**
IT = IT Infrastructure
ISQ = ERP System Quality
VS = Vendor Support
ST = Software Testing & Troubleshooting
ESA = ERP Software Appropriateness
Eigen = Local Priority Weight (Average per row)

G. Consistency Evaluation

Consistency Evaluation was performed to validate the reliability of expert judgments in the pairwise comparisons. The Consistency Ratio (CR) must be ≤ 0.10 to be considered acceptable. The formula for calculating the Consistency Ratio (CR) is presented in Table 13

TABLE XIII.
CONSISTENCY RATIO PARAMETERS AND CALCULATION FORMULA

Parameter	Description	Formula
Number of Criteria (n)	Total elements being compared	–
Λmax	Max eigenvalue (mean of AW/W)	λmax = mean(A · W / W)
Consistency Index (CI)	Degree of inconsistency	CI = (λmax − n) / (n − 1)
Random Index (RI)	RI value for n = 2	Based on Saaty's RI table
Consistency Ratio (CR)	Acceptable if CR ≤ 0.10	CR = CI / RI

To ensure the logical consistency of expert judgments, the consistency of the pairwise comparison matrix was thoroughly evaluated. This step is essential in the Analytic Hierarchy Process (AHP) as it ensures that the pairwise comparisons reflect a coherent set of preferences, thereby enhancing the reliability of the results. The consistency of both the ERP System Environment and Organizational Environment sub-criteria was specifically assessed using the Consistency Ratio (CR), as presented in Tables 14 and 15.

TABLE XIV.
CONSISTENCY CHECK – ERP SYSTEM ENVIRONMENT

Sub-Criteria	AW (A·W)	W (Eigen)	AW/W
IT Infrastructure	0.124	0.0237	5.2271
ERP System Quality	0.2524	0.0477	5.2869
Vendor Support	0.1606	0.03	5.3548
Software Testing	0.201	0.0369	5.4519
ERP Software Appropriateness	0.262	0.0469	5.5898
λmax			**5.3821**
CI			**0.0955**
RI			**1.12**
CR			**0.0724**

TABLE XV.
CONSISTENCY CHECK – ORGANIZATIONAL ENVIRONMENT

Sub-Criteria	AW (A·W)	W (Eigen)	AW/W
User Training	0.1594	0.031	5.1381
Top Management Support	0.2373	0.0461	5.1465
Business Process Reengineering	0.0888	0.0172	5.1564
Project Team Competence	0.1727	0.0336	5.1426
Clear Implementation Objectives	0.3418	0.0664	5.1517
λmax			**5.1471**
CI			**0.0368**
RI			**1.12**
CR			**0.0279**

The Consistency Index (CI) values for both categories: ERP System Environment (CI = 0.0955) and Organizational Environment (CI = 0.0368): fall well within the acceptable thresholds of CI ≤ 0.1**,** indicating a high level of consistency in expert judgments. A CR value of 0.0724 for the ERP System Environment and 0.0279 for the Organizational Environment further confirm that the judgments made by the experts were logically consistent and reliable. These results validate the coherence and accuracy of the expert evaluations used in the AHP methodology, ensuring robust conclusions for ERP success factors.

H. Priority Synthesis of ERP Implementation Success Factors

To prioritize the most influential factors in successful ERP implementation, this study employed the Analytic Hierarchy Process (AHP), a decision-making method particularly suited for problems involving multiple qualitative criteria. AHP was chosen over other multi-criteria decision-making (MCDM) techniques due to its structured hierarchy, flexibility in accommodating expert judgment, and consistency validation mechanism, which are critical in capturing nuanced preferences in ERP implementation contexts (Saaty, 1980).

The expert panel consisted of seven professionals with significant roles in ERP deployment, including project managers, IT strategists, and senior consultants from the Indonesian manufacturing sector. Experts were selected

based on three criteria: (1) direct involvement in ERP implementation within the last 5 years, (2) at least 5 years of experience in IT or manufacturing systems, and (3) familiarity with ERP evaluation frameworks. This purposive sampling approach enhances the credibility of prioritization outcomes, although it is acknowledged that subjectivity and small sample size are inherent limitations.

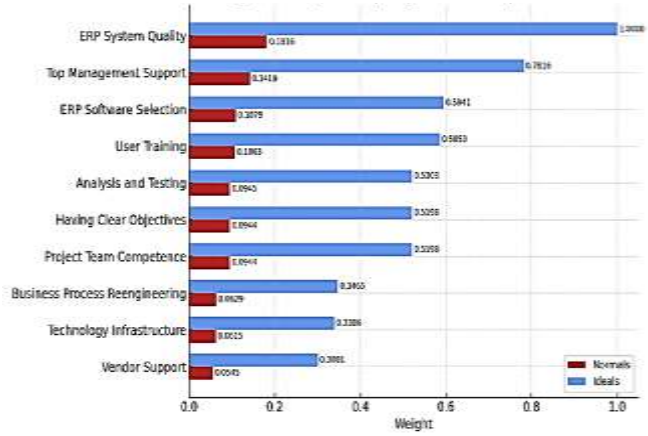


Fig. 4 Output Graph Synthesized SuperDecisions

Figure 4 illustrates the synthesized global priorities computed via SuperDecisions software. The ERP System Quality sub-criterion emerged as the highest priority with a normalized weight of 0.1816 and an ideal value of 1.0000, emphasizing the importance of alignment, reliability, and adaptability of the ERP system to organizational needs

This finding is consistent with foundational models such as [5] which identified system quality as a cornerstone of information system success. Supporting studies [10] [9] also reinforce that technological robustness significantly influences ERP performance. In this case, the top priority indicates that stakeholders place the highest value on system responsiveness, integration capabilities, and data accuracy.

The subsequent key factors were Top Management Support (0.1419) and User Training (0.1079). This aligns with the literature emphasizing organizational commitment and user readiness as critical enablers of ERP success ([9] [12]. Executive support often manifests in resource allocation, policy enforcement, and driving change management, while training ensures users are competent in leveraging ERP capabilities.

In contrast, Vendor Support and Business Process Reengineering (BPR) received lower weights (0.0544 and 0.0629 respectively), suggesting these are perceived as supporting, not leading, factors in the studied context. This may reflect the maturity level of internal processes at PT Multives, where external reliance is minimal, and reengineering has been completed in earlier ERP phases. In stable organizational settings, technical and managerial refinement may take precedence over structural overhaul.

The comparison of main dimensions shows that the ERP System Environment accounted for 53.9%, while the Organizational Environment contributed 46.1%, with a geometric mean ratio of 1.1699. Although the difference is relatively modest, it reflects a strategic orientation that slightly favors technical considerations. Nonetheless, the results emphasize the necessity of a balanced ERP implementation strategy that integrates both system functionality and organizational readiness.[22]

When compared with user perception data, several notable discrepancies were observed. For instance, *Vendor Support* received a low priority rating from experts, yet users reported relatively high satisfaction with vendor performance. This contrast suggests that expert assessments may undervalue operational elements that users find critical, such as helpdesk responsiveness and access to practical support materials. These findings emphasize the importance of establishing bidirectional feedback mechanisms within ERP governance to bridge the gap between strategic intent and day-to-day system experience [23].

In conclusion, this prioritization affirms the central role of System Quality, Executive Sponsorship, and Training in driving ERP success. At the same time, it suggests that organizations especially those in emerging economies should not overlook the evolving relevance of vendor collaboration and process agility. Future research could expand this model to multi-company comparisons and integrate more dynamic visualization tools such as radar charts or weighted impact matrices, as suggested by decision science scholars.

I. Comparison Between Strategic Priorities (AHP) and ERP User Perceptions

To enrich the validity and practical relevance of the AHP findings, this study conducted a comparative analysis between the strategic priorities derived from expert assessments and the actual perceptions of ERP system users. While the AHP model reflects the ideal strategic emphasis for ERP implementation success, the user feedback highlights real-world system performance, allowing for a multidimensional validation approach

As shown in Table 16, the consistency checks confirmed the robustness of both expert clusters. Each λmax was used to compute the Consistency Index (CI) and Consistency Ratio (CR), which were well below the acceptable threshold of 0.10, indicating logical coherence in the expert judgments [11].

TABLE XVI.
CONSISTENCY CHECK OF PAIRWISE COMPARISON MATRICES

ERP Environment	Eigen	Organizational Environment	Eigen
Technology Infrastructure	5.2271	User Training	5.1381
ERP System Quality	5.2869	Top Management Support	5.1465
Vendor Support	5.3548	Business Process Reengineering	5.1564
Analysis and Testing	5.4519	Project Team Competence	5.1426
ERP Software Selection	5.5898	Clear Implementation Goals	5.1517
λmax	5.3821	λmax	5.1471
CI	0.0955	CI	0.0368
CR	0.0724	CR	0.0279

To triangulate these strategic weights, user perceptions were gathered through a Likert-scale survey administered to 51 staff members across departments using the ERP system. Participants rated the performance of each success factor in their day-to-day work environment. The results are summarized in Table 17, which reveals several important gaps and alignments between expert-driven priorities and user-level experiences.

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TABLE XVII.
AVERAGE RESPONSES OF ERP USERS

Question	Average
How do you rate the factors influencing current ERP implementation performance in your company? [Technology Infrastructure in supporting ERP]	3.784
How do you rate the factors influencing current ERP implementation performance in your company? [Quality of the ERP System used]	3.765
How do you rate the factors influencing current ERP implementation performance in your company? [Vendor Support for the ERP system]	3.824
How do you rate the factors influencing current ERP implementation performance in your company? [Analysis, testing, and troubleshooting of software (Analysis, system testing, and responsiveness to issues)]	3.588
How do you rate the factors influencing current ERP implementation performance in your company? [ERP Software Selection]	3.784
How do you rate the factors influencing current ERP implementation performance in your company? [ERP User Training]	3.471
How do you rate the factors influencing current ERP implementation performance in your company? [Top Management Support for ERP]	3.863
How do you rate the factors influencing current ERP implementation performance in your company? [Business Process Reengineering: simplifying business processes to be optimally integrated into the ERP system]	3.765
How do you rate the factors influencing current ERP implementation performance in your company? [ERP Project Team Competence]	3.804
How do you rate the factors influencing current ERP implementation performance in your company? [Clarity of ERP Implementation Goals]	3.804

As shown in Fig. 5 ERP System Quality held the highest AHP priority (0.1816), it received only moderate satisfaction from users (3.765). This divergence suggests that although system quality is strategically emphasized, implementation gaps remain in terms of usability, reliability, or user customization. Similar observations were made by [24], who noted that many mature ERP systems struggle to meet evolving user expectations.

In contrast, Top Management Support scored highest among users (3.863) and also ranked second in AHP (0.1419), reflecting strong organizational leadership and alignment. However, a critical mismatch was found in User Training, which ranked third in AHP (0.1079) but received the lowest user satisfaction score (3.471). This gap may indicate training content misalignment, insufficient duration, or lack of continuous learning support.

A particularly notable contradiction appears in Vendor Support, ranked lowest in AHP (0.0544) but rated highly by users (3.824). This suggests that although internal planning may not strategically emphasize vendors, users view their role as pivotal, especially during troubleshooting and system updates.

Visualization of the perception gaps across sub-criteriaby comparing AHP priority scores with average user ratings provides a clearer view of areas where managerial focus and user experience diverge. These discrepancies underscore the need to involve both strategic decision-makers and end users in ERP evaluations, promoting an implementation approach that captures perspectives from both organizational levels.

Together, the data supports the conclusion that technical soundness alone is insufficient for ERP success. Strategic efforts must also address user readiness, contextual organizational factors, and post-deployment engagement to bridge gaps between expectations and realities. A more integrated and responsive ERP governance model, balancing strategic goals with human-centric insights, is essential for sustainable impact.



Fig. 5 Average User Perceptions on ERP Implementation Factors

V. CONCLUSION

A. Summary of Key Findings

This study aimed to identify and prioritize the Critical Success Factors (CSFs) influencing ERP implementation success in a manufacturing company, combining expert-based Analytic Hierarchy Process (AHP) with user perception analysis. The results indicate that ERP System Environment (53.9%) slightly outweighs Organizational Environment (46.1%) in influencing implementation performance. At the sub-criteria level, ERP System Quality emerged as the top priority (normalized weight = 0.1816), followed by Top Management Support (0.1419) and User Training (0.1079). These findings are consistent with prior research emphasizing the significance of technical alignment, leadership commitment, and human capability in ERP success (DeLone & McLean, 1992; Agouglu et al., 2015; Jusuf M. Mas'iffah, 2018).

Conversely, factors such as Vendor Support (0.0544) and Business Process Reengineering (0.0629) received lower priority, indicating a shift of focus toward internal readiness rather than external assistance particularly in organizations with mature ERP practices. This distinction between internal and external factors reflects the evolving needs of firms in sustaining ERP benefits beyond initial implementation phases.

B. Alignment and Gap with User Perception

To validate the AHP results and enhance credibility, user surveys were conducted to capture actual perceptions of ERP performance. While Top Management Support received the highest user rating (3.86), aligning with expert priority, a noticeable perception gap was observed in User Training ranked third in AHP but scoring the lowest in user satisfaction (3.47). This suggests a critical shortfall in training effectiveness, possibly due to insufficient delivery methods or mismatched user needs.

Vendor Support received the lowest priority in the AHP assessment, yet obtained a relatively high satisfaction score from users (3.82). This divergence suggests that, although vendor-related aspects may be underestimated during strategic planning, users perceive substantial value from

ongoing technical assistance provided by vendors. Such findings highlight the importance of aligning strategic prioritization with operational experience, reinforcing the need for ERP governance frameworks that are responsive to both planning-level considerations and day-to-day support needs.

The findings reflect characteristics of Indonesian organizational culture, such as hierarchical decision-making and reliance on external support. The undervaluation of vendor support by experts, despite high user satisfaction, suggests a top-down bias that overlooks operational realities. Similarly, gaps in user training may stem from passive learning norms and limited institutional emphasis on continuous development.

C. Managerial Implications

The identified gaps underscore the importance of adopting a dual-perspective ERP governance model that balances strategic alignment with user-centric improvements. First, organizations must invest in targeted training programs, ensuring content relevance and delivery effectiveness. Second, vendor support should be strategically re-evaluated, not merely as an external service but as a partner in sustaining long-term ERP value.

Furthermore, cross-functional ERP task forces involving IT, business users, and top management are essential to facilitate communication, reduce resistance to change, and enhance system usability. Viewing ERP as an ongoing organizational transformation, rather than a one-time technical deployment, is crucial for sustainable benefits.

D. Theoretical Contributions

This study offers several theoretical contributions to the ERP literature. By combining the Analytic Hierarchy Process (AHP) with user perception analysis, it introduces a multi-stakeholder evaluation framework that captures both strategic intent and experiential feedback. This dual-layered approach provides a deeper understanding of ERP implementation dynamics, particularly in the post-implementation phase.

The findings reaffirm the continued importance of system quality and top management support as key success factors, while also revealing underexplored mismatches between managerial priorities and user experience areas often overlooked in traditional models. In addition, the study highlights the contextual relevance of ERP success factors, especially within emerging-market firms where internal capabilities and leadership culture may exert stronger influence than vendor-driven technical support.

By addressing these aspects, the study enriches existing ERP success models and offers a theoretically grounded yet practically applicable framework for aligning strategic decisions with operational realities in resource-constrained environments.

E. Limitations and Future Research

Several limitations must be acknowledged. The sample size for both AHP experts (n=7) and user respondents (n=51) was relatively small and limited to a single company, which may affect generalizability. In addition, the AHP method, while structured, relies on subjective expert judgments and assumes consistency, which may not fully capture organizational complexity.

Future research is encouraged to:

- Apply this dual-method framework across multiple industries and organizations, allowing for comparative analysis;
- Explore hybrid models using Fuzzy AHP or ANP to address uncertainty in expert assessments;
- Conduct longitudinal studies to observe priority shifts across ERP lifecycle stages;
- Deepen analysis of the strategic-operational perception gap, especially in cross-cultural or resource-constrained settings.

F. Practical Recommendations

To enhance ERP outcomes in practice, several actionable steps are proposed:

- Enhance ERP training programs using modular, e-learning, and role-specific approaches to improve user adaptation.
- Establish structured feedback mechanisms from end-users to inform iterative system improvements.
- Maintain strong executive sponsorship, ensuring that top management continues to champion ERP as a strategic asset.
- Integrate vendor roles more strategically, leveraging their support not only for maintenance but also for continuous innovation.
- Monitor internal-external alignment regularly, using tools such as AHP-user feedback comparison to inform adaptive strategies.

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