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Identifying Critical Success Factors (CSF) in ERP Implementation Using AHP:

A Case Study of a Social Insurance Company in Indonesia

R. Hendra Kusumawardhana, Universitas Indonesia, Indonesia*
Imairi Eitiveni, Universitas Indonesia, Indonesia
Warda Yaziji, Universitas Indonesia, Indonesia
Zahrina Aulia Adriani, Universitas Indonesia, Indonesia

ABSTRACT

Enterprise resource planning (ERP) implementations often encounter multifaceted challenges, leading to failures. Success relies on technical competence, management support, and user engagement. Unique organizational processes significantly influence outcomes. Failures can disrupt operations, highlighting the need to identify critical success factors (CSFs) for effective ERP implementation. This study employed analytic hierarchy process (AHP) methodology to analyze CSFs. Data collection involved surveys administered to a social insurance company's ERP project team in Indonesia. This study revealed 15 success factors, categorized into organization, process, and technology dimensions. Organization emerged as the most crucial, followed by technology and process. Among these, five CSFs stood out: project team competence, vendor and consultant quality, ERP fit, top management support, and hardware and software selection.

KEYWORDS

Analytic Hierarchy Process (AHP), Critical Success Factor (CSF), Enterprise Resources Planning (ERP), Social Insurance

INTRODUCTION

Indonesia has several social insurance institutions established under the Act of National Social Security System (SJSN) (Kunarti et al., 2018). These institutions have business and operational processes that differ from typical insurance companies in terms of the scope of participants and stakeholders, the form of insurance products or programs managed, and the information systems (e.g., ERP) used. The variation in the range of participants is attributable to the regulations stipulating that social insurance in Indonesia is administered by a number of corporations and managing bodies. The participant

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scopes of these institutions vary, with certain ones catering to the military and police, civil servants, private employees, and civil servants (Bintang et al., 2019). The segmentation of participants in social insurance institutions, leading to the management of different insurance products or programs, sets them apart not only from each other but also from general insurance. These distinctions have a direct impact on the services and benefits provided to participants, encompassing service programs, premium variations, and benefit structures (Bintang et al., 2019; Kunarti et al., 2018). Consequently, social insurance institutions find themselves in the position of developing their own specialized enterprise resource planning (ERP) applications to effectively support their distinct operations and business needs. To achieve the optimal operational efficiency, organizations must gain a profound understanding of the critical success factors (CSFs) associated with ERP implementation. These domains and facets are considered to have an impact on the business continuity of an organization (Aini et al., 2020). Organizations that possess such an all-encompassing understanding of CSFs are able to precisely customize their ERP solutions to meet their needs while preserving superior quality and efficiency (Kausar & Budi, 2020; Hustad & Stenholt, 2022). Organizations have the potential to enhance data security, promote innovation, and mitigate long-term expenses by adopting this approach (Hustad & Stenholt, 2022). Therefore, it is crucial to understand CSFs in the context of ERP implementation in order to guarantee that substantial investments in ERP development result in long-lasting, favorable consequences while minimizing the implementation pitfalls that are inherent in the process. There has been a lack of research to date regarding the CSFs associated with the implementation of ERP in social insurance institutions. It has been acknowledged that the distinctive attributes of social insurance operations may exhibit substantial variations in comparison to those of other sectors. The insurance program in question incorporates distinctive attributes, such as the demographics of participants' backgrounds and ages, in addition to the participation of particular stakeholders – government institutions operating at the central and regional levels. Due to their inability to use pre-built ERP systems like SAP, Oracle, and others, social insurance companies are compelled to independently develop their own ERP application systems (Pakpahan et al., 2021). Therefore, since the ERP system under development differs from conventional ERP systems, adopting CSFs from other industries or extant studies may not adequately address the unique challenges and requirements of the social insurance domain. Thus, it is crucial to emphasize the significance of undertaking research that is precisely designed to shed light on these variables within the social insurance industry, thereby guaranteeing a successful and efficient execution in this distinctive setting. The research question in this study is as follows:

What are the critical success factors (CSFs) influencing the ERP implementation in social insurance companies in Indonesia?

BACKGROUND

ERP Implementation in PT XYZ

PT XYZ, as a social insurance company in Indonesia, implements social security programs that are regulated by the act of SJSN. Several factors distinguish social insurance or social security management from general insurance, including the following (Kunarti et al., 2018; Suryahadi et al., 2017).

- In both formal and informal sectors, membership is obligatory for all residents, and program participants are required to make a financial contribution.
- There are five programs: pension benefits, old-age benefits, health-related benefits, work accident compensation, and death benefits.
- There are four social insurance institutions or companies that manage the above programs according to different membership segments.

- The government establishes the National Social Security Council, which is tasked with supervising the management of the programs.
- The government bears the contribution costs for the poor.

PT XYZ provides social security protection for civil servants, including old-age benefits, pension benefits, work accident compensation, and death benefits (Sasmito & Ruldeviyani, 2020). Currently, PT XYZ has more than 1,400 employees serving over 6 million customers. To provide the best service and exceed customer expectations, PT XYZ has 57 branch offices and over 14,000 service points located throughout Indonesia.

PT XYZ has implemented an ERP system to enable its business and operations. Over time, this ERP system has undergone various transformations and developments to meet the organization's needs and to improve operational efficiency. These transformations aim to enhance the capacity and service quality to the customers. The company needs to make adjustments and implement modernization in line with its requirements to serve customers better by providing solutions to existing problems and following changes in regulations from the government and stakeholders.

There are two ERP systems in PT XYZ: the core ERP and the supporting ERP. Both applications are used at the head office and branch offices. Because the business processes of PT XYZ, a social insurance company, are distinct and cannot be accommodated by the standard ERP applications currently available in the market, the development and implementation of the core ERP are conducted autonomously. This differs from the supporting ERP, which can use the SAP ERP product due to the general nature of the supporting business processes.

Table 1 displays the implementation history of the two ERPs at PT XYZ. The core ERP implementation failed from 2016 to 2019, in contrast with the supporting ERP implementation, which was successful and made use of a completed enterprise product, SAP. After the implementation failure, the development of the core ERP application was resumed in 2020-2021, and the application was successfully completed. The implementation process of the core ERP application experienced various factors that influenced its success.

With the historical ERPs context at PT XYZ, encompassing the earlier core ERP failure and subsequent success, the identification of critical success factors (CSFs) for effective ERP implementation becomes imperative for the social insurance company. This is especially crucial when it comes to resolving difficulties that are comparable to those faced during the implementation of core ERP, thereby increasing the likelihood of future achievements. Significantly, in the development of ERP applications, neither PT XYZ nor other Indonesian social insurance companies have established CSFs that could function as benchmarks. The study aims to define and prioritize CSFs through the analytic hierarchy process (AHP) method. It is expected that this research will serve as a guideline for future ERP development, aligning with evolving needs. The analysis outcomes can subsequently be employed as recommendations for future ERP development and implementation.

Table 1. ERP Implementation History in PT XYZ

No.	Implementation Period	Usage Period	Application Platform	Application Name	Project Status
1	2003 - 2004	2004 - 2021	Visual Age	Core ERP	Done
	2003 - 2004	2004 - Now	SAP	Supporting ERP	Done
2	2016 - 2019	-	JAVA	Core ERP	Fail
	-	-	SAP	Supporting ERP	-
3	2020 - 2021	2021 - Now	.NET Core	Core ERP	Done
	-	-	SAP	Supporting ERP	-

ERP and Critical Success Factors (CSFs)

ERP is a modular, multifunctional system that facilitates the processing of internal business operations for organizations (O'Brien & Marakas, 2011). Establishing seamless operations for production and transactions, ERP is considered indispensable by organizations due to its capacity to integrate disparate organizational systems (Framinan et al., 2004). For increased efficacy, ERP can optimize business processes. Significant trends in the field can be discerned by consulting Table 2, which compiles a list of ERP factors sourced from multiple research publications in a manner that emphasizes similarity and frequency.

Table 2. CSF from previous studies

CSFs	References
Top Management Support	(Rahayul & Dillak, 2018; Kausar & Budi, 2020; Malik & Khan, 2020; Al-Fawaz, et al., 2008; Juniawan et al., 2022; Wicaksono et al., 2022)
Effective Project Management	(Rahayul & Dillak, 2018; Al-Fawaz et al., 2008; Kronbichler et al., 2009)
Business process Reengineering	(Rahayul & Dillak, 2018; Malik & Khan, 2020; Al-Fawaz et al., 2008; Aini et al., 2020)
Hardware and Software Selection	(Rahayul & Dillak, 2018; Kausar & Budi, 2020)
Education and Training	(Rahayul & Dillak, 2018; Al-Fawaz et al., 2008; Wicaksono et al., 2022)
Organizational Culture	(Kausar & Budi, 2020; Malik & Khan, 2020)
Implementation Process	(Kausar & Budi, 2020)
ERP Implementation Team Characteristics	(Kausar & Budi, 2020)
Project Team Competence	(Juniawan et al., 2022; Nagpal et al., 2017)
Clear Goals and Objectives	(Juniawan et al., 2022; Wicaksono et al., 2022)
Team Composition	(Juniawan et al., 2022; Kronbichler, 2009)
Organizational Change Management	(Malik & Khan, 2020; Juniawan et al., 2022; Wicaksono et al., 2022)
The Effectiveness of Project Leader	(Juniawan et al., 2022)
Cooperation between Team Members	(Juniawan et al., 2022)
End-User Involvement	(Al-Fawaz et al., 2008; Juniawan et al., 2022; Wicaksono et al., 2022; Kronbichler et al., 2009)
Testing and Start-up of the System	(Juniawan et al., 2022)
Organizational Impact	(Aini et al., 2020)
Information Quality	(Aini et al., 2020)
Individual Impact	(Aini et al., 2020)
Workgroup Impact	(Aini et al., 2020)
Vendor and Consultant Quality	(Malik & Khan, 2020; Aini et al., 2020; Kronbichler, 2009)
System Quality	(Aini et al., 2020)
ERP Fit	(Kausar & Budi, 2020; Al-Fawaz et al., 2008; Juniawan et al., 2022; Aini et al., 2020; Wicaksono et al., 2022)

Previous studies are detailed in Table 2, which is supported by confirmation from the case organization's primary ERP implementation project team. The subsequent list comprises 15 critical success factors that must be considered when implementing ERP at PT XYZ, a social insurance company.

Top management support. For ERP implementation, having strong support from top leaders across different departments is important to keep the project going and provides the resources needed, such as people, money, and tools (Rahayul & Dillak, 2018; Al-Fawaz et al., 2008). Top managers also need to understand how the system can help, set reasonable goals, show their commitment, and make sure everyone knows the plan (Rahayul & Dillak, 2018). This support should continue throughout the project, including giving direction to the teams and checking on progress (Rahayul & Dillak, 2018; Al-Fawaz et al., 2008).

Effective project management. Effective project management requires monitoring the progress of an ERP project and ensuring that it is suitable for the intended purpose by applying acquired knowledge and abilities. The project plan is crucial for ensuring that the entire ERP endeavor is organized. It serves as a strategic guide delineating essential elements, tasks that need to be completed, and the individuals responsible for carrying them out. Setting up an ERP system can become complex, leading to unforeseen challenges. To address these unexpected issues and minimize their effects, we need to manage risks by identifying potential problems in advance (Kronbichler et al., 2009).

Effective project management encompasses the following: overseeing the scope of the project, establishing a comprehensive project plan and timetable, specifying the precise objectives of the undertaking, mitigating risks, ensuring seamless integration of personnel, methodologies, and technology, and reaching consensus on every phase of the undertaking (Kronbichler et al., 2009). Successful execution of the ERP system is facilitated when each of these activities is executed; consequently, this promotes the efficiency of every business function (Rahayul & Dillak, 2018).

Hardware and software selection. The choice of hardware and software should be aligned with the company's specific needs. If the requirements are fulfilled by the basic module, there is no need to procure additional modules. Additionally, the ERP system should be chosen in a manner that allows for effortless customization to cater to the company's unique conditions and ensures easy upgradability. Continuously enhancing the system's advantages is essential, and care should be taken to ensure that these improvements do not disrupt the configurations of existing computer systems (Rahayul & Dillak, 2018; Kausar & Budi, 2020).

Education and training. Education and training involve preparing employees and management by explaining the logic and overall concepts of the ERP system. They ensure that employees and management understand the logic, concepts, and the interrelation of their work with other functional areas of the company. The goal of this training is to enhance expertise, knowledge, and skills across the board (Rahayul & Dillak, 2018). Not only does training shape shared beliefs about the system's benefits, but its absence could be a significant roadblock to effective implementation (Malik & Khan, 2020). The shift in business processes due to the new system is vital, and any lack of user training might hamper successful integration. Therefore, viewing training as an integral part of the implementation process, especially for data intelligence systems, and heightens the likelihood of success (Merhi, 2021).

Project team competence. Project team competence encompasses both technical and functional expertise, which plays a pivotal role in ensuring the success of an ERP project (Nagpal et al., 2017). The importance of expertise within the project team becomes especially clear when team members exhibit a deep grasp of the complex business processes within each sector (Juniawan et al., 2022). Furthermore, it is imperative for every team member to fully embrace their designated roles, foster a culture of productive collaboration, promote a culture of effective teamwork, and

uphold open communication within the team (Nagpal et al., 2017). If all these elements are adopted, the team can expect to reap benefits such as enhanced performance, minimized conflicts, and heightened motivation among team members.

Clear goals and objectives. The success of a project is inherently linked to the predefined goals, making it critical to have well-defined aims and objectives from the commencement of execution. With clear objectives for system implementation, it becomes easier for the team to develop the ERP in line with these goals. However, the team faces its own challenges in upholding the expectations related to these goals. Setting objectives is necessary to frame these expectations (Juniawan et al., 2022).

Team composition. Having the right mix of people and effective teamwork is essential for a successful ERP implementation (Kronbichler et al., 2009). This involves collaboration across all functional departments, including technical and business experts, external consultants, and end-users in various project phases. The ERP project team includes personnel from different areas, with their knowledge and skills contributing to project success. While external consultants play an indispensable role, they are advisory rather than long-term additions to the team. Their expertise is particularly valuable in implementing new technology. Essential factors for success encompass project team competence, dedicated resources, effective use of consultants, balanced team composition, and representation from various functional areas (Kronbichler et al., 2009).

To achieve successful ERP implementation, the team must comprise a project manager, an integration function, responsible consultants for each module, and other key members. Additionally, technical experts well-versed in ERP best practices are vital, along with infrastructure for application landscapes (Juniawan et al., 2022). This comprehensive approach aligns with the pivotal elements highlighted in the previous discussion (Kronbichler et al., 2009).

Organizational change management. Changes often occur within an organization, including social insurance companies. These changes can involve structural shifts through position mutations and rotations, alterations in company culture, modifications to business processes, and other changes. With the aid of a project team, the company gains insights into the current and future business processes. In the event of future business process modifications, the presence of key role users with a thorough grasp of the ERP implementation process becomes vital (Juniawan et al., 2022).

Cooperation between team members. The success of ERP implementation greatly hinges on the cooperation and effective collaboration among team members. The involvement of representatives from various roles and modules, coupled with transparent communication, forms the bedrock of a successful ERP project. By means of this collaborative endeavor, not only is the seamless integration of the ERP system guaranteed, but it also facilitates the development of novel approaches to problem-solving and achievement of project milestones (Juniawan et al., 2022).

End-user involvement. Participation of users in the decision-making process may increase their affinity for the new system and foster a sense of ownership. The contributions of these individuals are particularly noteworthy, particularly when obstacles arise during the phase of accumulating requirements and the vendor verifies the results of the enterprise resource planning system (Kronbichler et al., 2009). Furthermore, it is of equal importance that end users exercise caution and diligence in verifying the accuracy, completeness, and veracity of data throughout the migration procedure (Juniawan et al., 2022).

Testing and start-up of the system. Every program must undergo testing to confirm its functionality and minimize potential issues. The primary focus of testing is to evaluate the ERP's resilience and robustness under various conditions. At this phase, stress tests, including performance tests, are essential. Given that the ERP system integrates with other systems, system integration tests are of the utmost importance (Juniawan et al., 2022).

Information quality. Information quality is of utmost importance in any organizational setting as it directly influences decision-making and strategic planning. Information quality refers to the relevance, accuracy, timeliness, and comprehensibility of data, which are essential for making informed decisions. Therefore, enhanced ERP implementation performance and more streamlined operations result from the utilization of high-quality information (Aini et al., 2020).

Vendor and consultant quality. The partnership with an ERP implementer-vendor becomes very important when we consider how each company has its own ideas about how to use a system and the level of technical expertise and adaptability of the vendor and consultant in designing an ERP solution tailored to the company's needs. This can be different from what the ERP vendor suggests, and it can be challenging to make these different ideas work together (Kronbichler et al., 2009). The assessment of vendor and consultant quality in ERP projects encompasses several criteria. These criteria involve evaluating the quality of vendors and consultants, assessing their effectiveness in communication and collaboration, and considering the value of their consulting services (Aini et al., 2020). Within an ERP project, it is of utmost importance that both the vendor and consultant contribute to the development of a tailored, high-quality ERP system. Their collaborative efforts are vital in ensuring the project's success, guaranteeing its smooth execution, and facilitating the correct utilization of the system (Malik & Khan, 2020; Aini et al., 2020).

System quality. System quality refers to the effectiveness of an information system in achieving its intended purpose. It involves factors such as reliability, usability, adaptability, and how seamlessly it can integrate with existing processes. High system quality ensures smoother operations, increased efficiency, and can significantly enhance user satisfaction and overall organizational ERP implementation performance (Aini et al., 2020).

ERP Fit. Creating the right ERP system is a complex task, especially when aiming for a system that aligns precisely with the unique needs of an organization like XYZ. Off-the-shelf packages often fall short in providing all the necessary functionalities. Therefore, the selection of a flexible ERP provider becomes paramount. Key criteria for this selection process encompass the system's alignment with current business processes and compatibility with existing systems so the information system integration can be carried out effectively. Moreover, adaptability and seamless upgradability take on critical roles in ensuring long-term success (Rahayul & Dillak, 2018; Al-Fawaz et. Al, 2008). Achieving a harmonious integration of diverse components stands as a fundamental objective in ERP implementation, requiring a proficient amalgamation of various technical aspects (Aini et. Al, 2020).

Multi-criteria decision-making (MCDM). MCDM is a process that involves the evaluation and selection of alternatives based on multiple, often conflicting criteria. In this approach, complex issues are analyzed by considering a variety of factors and assessing their relative significance. Typically applied in scenarios where decisions require a comprehensive evaluation of diverse attributes and potential outcomes, MCDM is integral to structured decision-making processes (Rezaei, 2015).

Among the various MCDM methodologies, such as the best-worst method (BWM), TOPSIS, ELECTRE, VIKOR, and PROMETHEE (Rezaei, 2015), the analytic hierarchy process (AHP) was selected for our research due to its distinct advantages.

Analytic Hierarchy Process. Thomas L. Saaty, a mathematician and computer scientist, introduced the analytic hierarchy process, a method specifically developed to assist in decision-making scenarios that involve numerous criteria or alternatives (Saaty, 1988). This method facilitates decision makers in comprehending the significance and relevance of the factors discussed in the study. AHP employs mathematical techniques to convert subjective or vague factors into quantitative

variables, enabling researchers to objectively evaluate alternatives (Azmi & Trisminingsih, 2017; Wijiastuti et al., 2021).

AHP works by breaking down the decision problem into a hierarchy of simpler criteria and sub-criteria. The decision maker then provides relative rankings to these criteria through pairwise comparisons. Once all comparisons are done, the results are synthesized to determine the overall rankings of the alternatives. This process helps reduce the complexity in decision-making and enables decision makers to make more objective and accurate decisions. (Merhi, 2021)

AHP ascertains the significance of each criterion through pairwise comparison, drawing from the expertise of professionals. Saaty proposed that the most effective scale to represent opinions ranges from 1 to 9. Table 3 illustrates the qualitative evaluation scores and the descriptions of comparison scale (Malik & Khan, 2020).

The process of determining the priority of each decision element at various levels of the hierarchy involves using mathematical formulas like vertical calculations within the weight matrix A to procure eigenvectors (ϖ) (Merhi, 2021). These eigenvectors denote the significance of each criterion. Eigenvalue (λ) can be calculated using a specific formula. Matrix A is derived from expert evaluations, with its size contingent upon the number of factors or subfactors being assessed. Geometric mean of each row in matrix A gives the eigenvectors (Saaty, 1988).

$A \cdot \omega = \lambda \max \omega$ (Sianipar et al., 2019)

Human judgement is not invariably consistent, but AHP provides a certain level of leniency for minor inconsistencies. To validate the consistency of the comparison matrix, one must first derive the consistency index (CI) using a specific formula where N stands for the number of criteria in the comparison matrix. Following this, the consistency ratio (CR) is to be determined. An expert's judgement is deemed consistent if the CR value is equal to or less than 0.1. The index ratio (IR) value has been predefined by Saaty and is contingent upon the value of N, attached in Table 4 (Azmi & Trisminingsih, 2017).

$$CI = \frac{\lambda \max - N}{N - 1}$$ (Azmi & Trisminingsih, 2017; Halim et al., 2020)

$$CR = \frac{CI}{IR}$$ (Sianipar et al., 2019)

Table 3. Paired comparison of various factor in AHP (Gupta et al., 2022; Wicaksono et al., 2022)

Scale	Numerical Analysis	Reciprocal
1	Equal importance	1
3	Moderate importance	1/3
5	Strong importance	1/5
7	Very strong importance	1/7
9	Extreme importance	1/9
2,4,6,8	Intermittent values between two adjacent scales	1/2, 1/4, 1/6, 1/8

Table 4. Random consistency index

Size of Matrix	Random Consistency Index (Index Ratio)
1	0
2	0
3	0.58
4	0.90
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49
11	1.51
12	1.48
13	1.56
14	1.57
15	1.59

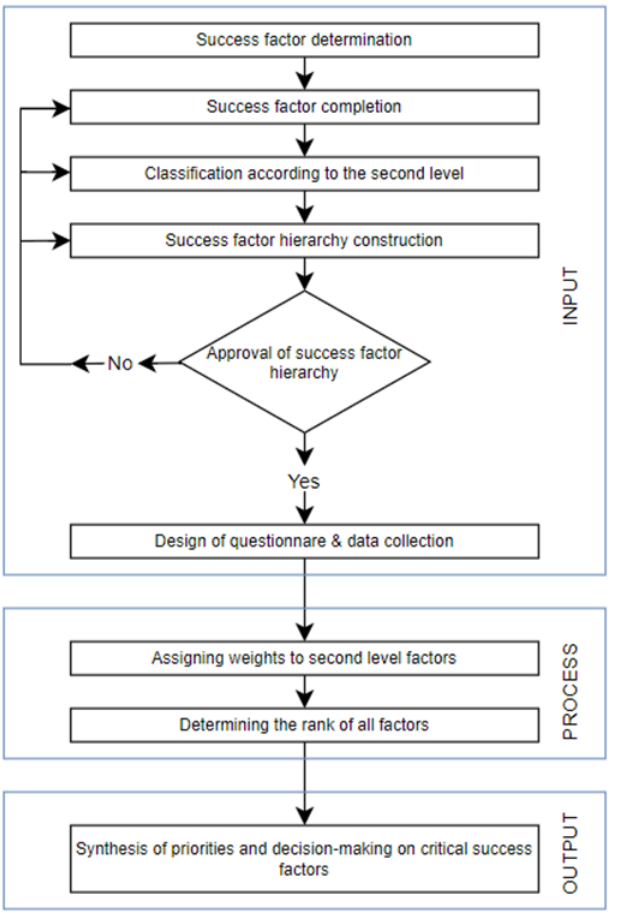
RESEARCH METHODOLOGY

Research Phase

This study was carried out in three main stages: input, process, and output, as illustrated in Figure 1. During the input phase, success factors were identified by conducting a comprehensive literature review, which resulted in the identification of 23 unique CSFs (Table 2) derived from previous studies focusing on the success factors in ERP implementation. Between 2016 and 2019, these 23 CSFs were cross-referenced with the members of the project team for PT XYZ's primary ERP implementation. Subsequently, from the initial list of 23 factors identified in various previous studies, a selection and grouping process was undertaken by eight respondents, as detailed in Table 5, reducing the list to 15 factors. This process was aimed at determining the relevance of these factors to the specific needs and operational structure of the company, ensuring that the selected factors accurately reflected the unique conditions and requirements of the company. Due to PT XYZ's distinctive attributes as a social insurance provider, which set it apart from other organizations, this approach was required. Additional justification for this was that the members of the project team had direct experience with the fundamental ERP implementation procedure, which provided them with a comprehensive comprehension of its complexities. Then, we determined the factors' relative importance through measurement and evaluation using the analytic hierarchy process.

The AHP involves a six-step calculation process with three levels of weights. First, a decision hierarchy is established, comprising the main goal at the top, followed by criteria (level 1), sub-criteria (level 2), and alternatives (level 3). Second, pairwise comparisons are conducted for each element at every level relative to elements at the level above. Third, local weights are calculated using the Saaty scale (typically 1 to 9) and entered into a comparison matrix, utilizing eigenvector or normalization methods. Fourth, consistency of the comparison matrix is checked using the consistency ratio, and

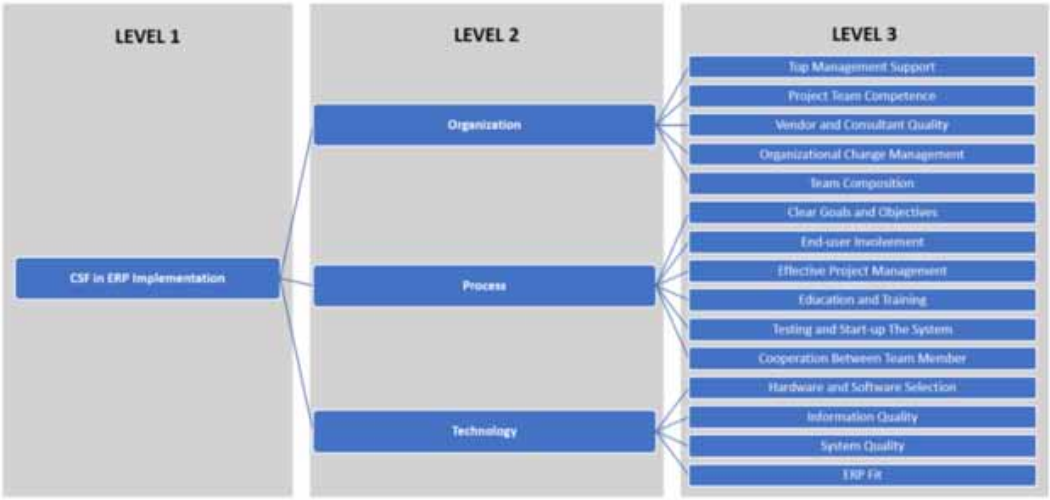
Figure 1. Research process



matrices with a CR over 0.1 are revised for consistency. Fifth, global weights of each sub-criterion (or alternative) are calculated by multiplying their local weights with the global weights of the corresponding criteria (or sub-criteria). Lastly, in the sixth step, global weights of all alternatives are aggregated to derive the final score.

Following the finalization of the factors, they were classified into a second level according to the following three primary criteria: organization, process, and technology (Merhi, 2021). As depicted in Figure 2, a hierarchy of these success factors was subsequently established; this hierarchy served as the framework for the subsequent research. This constructed hierarchy was submitted for approval by AHP method experts. Two experts were involved in the approval procedure for the hierarchical structure. The initial expert served as a supervisory consultant for PT XYZ's ERP implementation project. This was due to the consultant's comprehensive comprehension of the ERP implementation project, having witnessed its evolution from commencement to completion. An additional factor to consider was the consultant's 13 years of experience as a planning, development, and supervisory consultant on various software development and ERP implementation projects. The second expert was a consultant who possessed 20 years of experience as an AHP facilitator in addition to expertise in conducting research utilizing the AHP method. In the event that the hierarchy failed to receive approval, this study was redirected to the phase that necessitated revisions, be it the classification, finalization, or hierarchy construction.

Figure 2. Success factor hierarchy structure



Once the necessary approval was obtained, data collection and the development of a questionnaire commenced. The distribution of the questionnaire was limited to team members occupying strategic positions and possessing extensive knowledge of the project's lifecycle. The collected data was utilized to designate weights to the second level factors at the initiation of the process stage, thereby facilitating the ranking of all factors according to these weights. The study came to a close with the synthesis of priorities and decisions concerning critical success factors during the output phase.

DATA COLLECTION AND ANALYSIS

A questionnaire that was distributed to a specific sample of respondents was used to collect data using a quantitative method, as detailed in Table 5. The respondents in question held strategic positions and were essential members of the team that implemented the core ERP system. They possessed a thorough comprehension of the project's lifecycle (Azmi & Trisminingsih, 2017). A total of eight respondents were selected for this study.

Table 5. Questionnaire respondents

Respondent Code	Role in Project
R1	Steering Committee
R2	Project Manager
R3	Deputy Project Manager
R4	Subject Matter Expert (SME)
R5	Project Management Officer (PMO)
R6	Business Analyst
R7	System Analyst
R8	Technical Development

Utilizing a scale ranging from 1 to 9, the questionnaire was designed and distributed to the eight participants. Calibration of priority preferences was facilitated by this scale, with values between A and B serving as reference points. Table 6 provides a graphical representation of the scale's configuration, illustrating how priority tendencies can be modified to correspond with the scale elements in question.

In the data collection process, specific steps were taken to ensure the accuracy and reliability of responses. Before distributing the questionnaire, respondents were provided with detailed information about each critical success factor. The purpose of this information session was to prepare respondents with a good understanding of the factors to be assessed. During the completion of the questionnaire, respondents were accompanied to avoid any misunderstandings or misinterpretations. This assistance allowed respondents to immediately clarify any questions or doubts that arose, ensuring that their responses accurately reflected their opinions and experiences.

For analytic hierarchy process data analysis, the information gathered for this study was subsequently processed via the online application BPMSG.com. Business Performance Management Singapore (BPMSG) is a business management consulting firm that offered an extensive range of resources. A useful aid for those utilizing the AHP methodology for decision-making was an online AHP calculator, which was one of these resources (Sianipar et al., 2019)

After the data processing was completed, the extracted data was obtained through a CSV export. To commence the process of establishing CSFs, it was imperative to ascertain that the acquired data exhibited superior quality by ensuring that the CR was substantially reduced to a level below 1%.

RESULTS

The CR results from all respondents can be seen in Table 7. The table is discernible that the CR value obtained is less than 1%. This value indicates a high level of consistency in the respondents' evaluations, rendering the data reliable for further analysis. With such an acceptable CR value, it is reasonable to confirm that all the data collected from the respondents can indeed be used in the determination of the CSFs.

Table 6. Questionnaire form

A	Comparison Score																B
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	

Table 7. Pairwise comparison consistency rate

PWC Consistency Rate	Factors on Level 2	Factors on Level 3		
		Organization	Process	Technology
R1	0.019090	0.021699	0.026716	0.011357
R2	0.000000	0.017177	0.006597	0.011357
R3	0.009608	0.036551	0.078755	0.011357
R4	0.019090	0.012310	0.016168	0.016794
R5	0.000000	0.011813	0.016168	0.003800
R6	0.009608	0.007362	0.012903	0.029800
R7	0.009608	0.002215	0.031585	0.010168
R8	0.009608	0.027451	0.025944	0.007558

Table 8 presents the weighted percentage of different factors and criteria at level 2 and their respective rankings. The weights assigned at level 2, namely 0.542174 for Organization, 0.184813 for Process, and 0.273013 for Technology, are utilized as the base for calculating the weights of level 3 factors.

Under the organization category, five factors are listed with their respective weight percentages and rankings. Project team competence has the highest weight (0.327343) and ranking of 1, followed by vendor and consultant quality with a weight of 0.301772 and ranking of 2. Top management support ranks third with a weight of 0.211721. The factors team composition and organizational change management have weights of 0.089401 and 0.069762, ranking fourth and fifth, respectively.

The process category includes six factors. Effective project management leads with the highest weight (0.365208) and ranking of 1. It is followed by end-user involvement and education and training, with weights of 0.253103 and 0.180591, and rankings of 2 and 3, respectively. Cooperation between team members and clear goals and objectives follow, while testing and start-up system ranks last with a weight of 0.060228.

Lastly, the technology category has four factors. ERP fit holds the highest rank with a weight of 0.424175, followed by hardware and software selection and system quality, with weights of 0.272462 and 0.204271, respectively. Information quality has the lowest weight of 0.099091 in this category.

Each factor's overall weight and ranking among all the factors (across all categories) are also provided. For instance, project team competence from the organization category has an overall weight

Table 8. Results of factors percentage

Factors Percentage	Weight Percentage Between Level 2 Criterion	Ranking	Weight Percentage Between Level 2 Criterion	Ranking	Weight Percentage Among the Factors	Overall Ranking
Organization	0.542174	1				
Top management support			0.211721	3	0.11479	4
Project team competence			0.327343	1	0.177477	1
Vendor and consultant quality			0.301772	2	0.163613	2
Organizational change management			0.069762	5	0.037823	10
Team Composition			0.089401	4	0.048471	9
Technology	0.273013	2				
Hardware and software selection			0.272462	2	0.074386	5
Information quality			0.099091	4	0.027053	12
System quality			0.204271	3	0.055769	7
ERP fit			0.424175	1	0.115805	3
Process	0.184813	3				
Clear goals and objectives			0.068772	5	0.01271	14
End-user involvement			0.253103	2	0.046777	8
Effective project management			0.365208	1	0.067495	6
Education and training			0.180591	3	0.033375	11
Testing and start-up system			0.060228	6	0.011131	15
Cooperation between team members			0.072098	4	0.013325	13

of 0.177477 and ranks 1 among all factors. The second rank factor is vendor and consultant quality from the organization category, with an overall weight of 0.163613. The third rank factor is ERP fit from the technology category, with an overall weight of 0.115805. The fourth rank factor is top management support from the organization category, with an overall weight of 0.114790. The fifth rank factor is hardware and software selection from the technology category, with an overall weight of 0.074386.

The weights and rankings reflect the relative importance of each factor in determining the CSFs for the ERP implementation in the social insurance company. To streamline the interpretation of the results, the measurement of the CSFs, based on their respective percentages and rankings, is graphically represented in Figure 3.

DISCUSSION

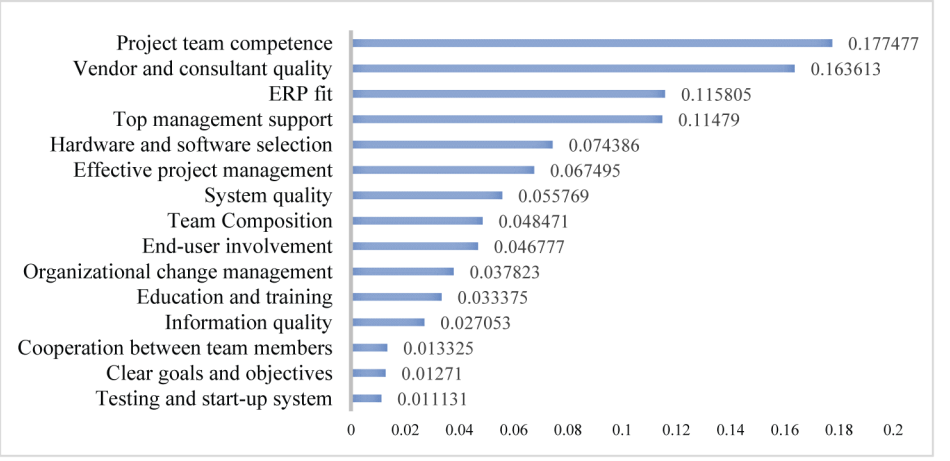
In this study, we conducted an analysis of the CSFs in ERP implementation within the context of a social insurance company in Indonesia using the AHP method. Our analysis produced a ranked list of the critical success factors influencing this project. In Table 9, our findings are compared with those of several related studies to gain a deeper understanding of these factors.

Some key insights can be drawn from Table 9:

- Factor variability: Across different columns, several factors are observed to reappear. For instance, top management support, project management, effective communication, and organizational culture are found in multiple columns.
- Consistency in assessment: In other studies, certain factors like top management support are consistently seen to rank high, suggesting that support from top management is deemed critical in various contexts.
- Differing opinions: While consistent high or low rankings are given to some factors across columns, there are factors whose rankings are noted to vary among columns. For instance, in Study 9, project management is ranked high, but in other columns, it is seen to rank lower.

Several factors that might influence the differences in opinion in the success factor rankings are shown in Table 9.

Figure 3. Results of all factors percentage diagram



- Business process characteristics (Halim et al., 2020; Hustad & Stenholt, 2022): PT XYZ, a social insurance company with distinct business processes, stands apart from conventional insurance firms. Factors that hold paramount importance for companies following standard procedures might not wield the same influence for PT XYZ. Unlike firms adopting packaged solutions like SAP, PT XYZ has developed its core ERP to align with its exceptional business processes. Consequently, the factors pertinent to in-house development may diverge from those applicable to package solution implementation.
- Regulatory context (Kunarti et al., 2018; Suryahadi et al., 2017): Operating in Indonesia, PT XYZ is required to comply with dynamic government regulations and stakeholder requirements, which can influence their priorities and needs. In the future, this dynamic regulatory landscape might require continuous updates and modifications to their ERP applications.

The presence of dynamics in the ERP implementation process within PT XYZ is apparent from Table 1, ERP implementation history, particularly in light of the core ERP implementation failure that transpired between 2016 and 2019. This suggests that the success or failure of the implementation may have been influenced by specific factors, which may be distinct from those deemed crucial by other organizations.

IMPLICATIONS

In the context of PT XYZ, the findings of this research reveal concrete benefits of ERP system implementation. The importance of high-quality information systems for enhancing user trust and work performance suggests that PT XYZ should provide timely and relevant information within the ERP system (Kautsar, 2020). It also suggests the need for a holistic approach in ERP implementation that includes technology, business transformation, and management support (Finnet & Corbett, 2007). Considering stakeholder preferences in ERP decision-making is also important. Successful ERP implementation can improve organizational performance through top management support, team competence, user training, and adequate IT infrastructure (Saaty, 1988).

The previous failure in ERP implementation between 2016 and 2019 provides valuable lessons, indicating that there might be factors that were overlooked (Malik & Khan, 2020). Moreover, given the absence of well-defined CSFs for the social insurance industry in Indonesia, this study sets a precedent that can benefit other enterprises within this sector (Wijayanto et al., 2021; Suharto et al., 2019). Additionally, the implementation of ERP at PT XYZ can automate business processes, reduce data redundancy, and speed up workflows, thus enhancing operational efficiency.

CONCLUSION

This research provides a general overview of the critical success factors in the implementation of enterprise resource planning in organizations or companies operating in social insurance in Indonesia. The lack of prior research on the implementation of ERP in social insurance companies in Indonesia prompted the investigators to focus on CSFs associated with ERP implementation in these organizations (Kamal et al., 2020) and makes this study a reference for other studies in the field of ERP or other studies where the case study is a social insurance company.

This study identifies general CSFs identified at level 1 and identified from several categories: organization, process, and technology identified at level 2, and 15 CSFs at level 3. For the organization category, the CSFs with the highest importance are project team competence, vendor and consultant quality, and top management support. For the process category, the CSFs with the highest importance are effective project management and end-user involvement. For the technology category, the CSFs with the highest importance are ERP fit and hardware and software selection. In general, the CSFs

Table 9. Comparative critical success factors (CSF) in ERP implementation

Rank	The Findings of This Study	(Merhi, 2021)	(Halim, Mubarokah, and Hidayanto, 2020)	(Wicaksono, Wicaksono, Aditya et al., 2022)	(Wijayanto, Raharjo, Hardian et al., 2021)	(Wijiastuti, Raharjo, and Herdian, 2021)
1	Project Team Competence	Project Management	Source System	ERP selection	Clear on vision and objective	Project Scope and Requirement management
2	Vendor and consultant quality	IS &Data	Project leader/ champion	Training & Education	Project manager's capability	Project management Process
3	ERP fit	Data quality	User Participation/ Involvement	Technological infrastructure	Clear communication	Project Manager Skills and Leadership
4	Top Management Support	Top Management Support	Well-defined System Requirement	Effective communication	Reliable infrastructure	Capability and competency of the Project team
5	Hardware and software selection	Technical infrastructure	Effective Data management	Clear goals	Customer involvement	Stakeholder involvement and collaboration
6	Effective Project Management	Organizational culture	Appropriate Skills	Vendor Competency	Team capability	Top-Level management support
7	System quality	Training & Education	Clear business objectives	Data Accuracy	Project schedule	Infrastructure
8	End-user involvement	Security & Privacy	System Integration	User involvement	Project control	Communication and collaboration
9	Team Composition	Clear vision	Executive involvement and commitment	Change management & culture	Management of Requirement	Knowledge management
10	Organizational change management	Integrations	IT Staff collaboration with consultants	Legacy System consideration	Risk management	Organizational culture
11	Education and Training	Adequate resources	Project management	System Reliability		
12	Information quality	Compatibility	Extensive management support	Top management support		
13	Cooperation Between Team Members	Teams Skills & Composition		IT Skills Organizations		
14	Clear goals and Objectives	Change management		Business Process Reengineering		
15	Testing and start-up System					

with the highest importance are project team competence and vendor and consultant quality. If ranked overall, the five most important CSFs in order are project team competence, vendor and consultant quality, ERP fit, top management support, and hardware and software selection.

We conclude that the ERP implementation project in social insurance companies is significantly different from ERP implementation projects in other organizations in general (Pakpahan et al., 2021). This is due to the uniqueness of the business and operational processes between social insurance and other organizations or companies. This is reflected in the assessment of the organization and process aspects that place project team competence, vendor and consultant quality, and top management support in the top five most influential CSFs in ERP implementation in social insurance companies.

In addition, the technology side is also important, as seen in the technology aspect assessment which places ERP fit and hardware and software selection in the top five most influential CSFs in

ERP implementation in social insurance companies. Based on these facts, it can be seen that ERP implementation in social insurance does not use a ready-made ERP application but develops from the beginning because the database structure, applications, and infrastructure are different and cannot be equated with other organizations (Hustad & Stenholt, 2022). These are the findings that indicate this research will be useful in the process of implementing ERP in PT XYZ and other social insurance companies in Indonesia where they can consider the most CSFs to be observed and monitored in its implementation (Pakpahan et al., 2021).

Additionally, the grouping of factors into three main criteria – organization, process, and technology – was a practical approach for this study (Azmi & Trisminingsih, 2017; Gupta et al., 2022; Halim et al., 2020; Wicaksono et al., 2022; Sianipar et al., 2019; Suharto et al., 2019).

LIMITATIONS

This study, focused on a social insurance company in Indonesia, faces limitations in terms of scope and generalizability of findings. This is closely related to the criticism of the hierarchical structure used in the AHP methodology applied in the research. The hierarchical structure of AHP may not be suitable to model the complexities of certain scenarios, especially in contexts that are broader or different in terms of industry and culture, due to the lack of flexibility in the structure to consider specific characteristics of actual scenarios (Munier & Hontoria, 2021). Moreover, this study relies on the subjective judgments of experts through the AHP method, which could introduce bias and limit the objectivity of the findings. This criticism of AHP underscores that the method may not be capable of addressing more complex issues due to its structure, which is akin to the old military-like organizational structure, characterized by top-down decision-making without considering other inputs (Munier & Hontoria, 2021). Regarding sample size and selection, the validity of the results could be affected if the sample does not reflect the broader population within the company, highlighting further limitations in using AHP which sometimes only deals with subjective preferences without integrating the diverse perspectives existing in complex realities (Munier & Hontoria, 2021). Finally, the study might not fully account for external factors like economic fluctuations, regulatory changes, or market dynamics that could impact ERP implementation success, aspects often overlooked in the hierarchical modeling of AHP that tends to oversimplify real-world issues (Munier & Hontoria, 2021).

FUTURE WORK

Although this study has provided valuable insights into identifying critical success factors for ERP implementation, it also highlights certain implications. One significant implication arises from the exclusive reliance on the analytic hierarchy process method, which may suggest the need to incorporate alternative data processing methods to enrich CSF identification with diverse perspectives. It is important to acknowledge that different contextual factors may warrant alternative grouping strategies, and future research should explore such possibilities (Wijayanto et al., 2021; Wijiastuti et al., 2021). This would ensure a more comprehensive understanding of the nuances surrounding ERP implementation.

For future work, the findings of this study on enterprise resource planning implementation are poised for broader application across various domains beyond social insurance companies. This includes exploring the impact of ERP systems on employee performance in areas such as financial management, and customer service. In financial management, ERP systems hold potential for exploring the effectiveness of ERP in managing financial transactions, budgeting, and financial reporting. Moreover, the utilization of ERP systems in customer service is another promising area. These diverse domains represent significant opportunities for future research to uncover how ERP systems can elevate operational efficiency and employee performance in various organizational settings.

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R. Hendra Kusumawardhana has a bachelor's degree of computer engineering from Universitas Indonesia (2009-2013) and an ongoing Master's in Information Technology in Universitas Indonesia, expected to be completed in 2024. With a keen interest in IT infrastructure, data center, computer network, information security, information system, and IT governance, Hendra has obtained several important certifications, including EC-Council Certified Network Defender (2017), IT Infrastructure Library v.4 (2021), Certified Data Center Specialist (2022), Fortinet Network Security Expert Level 4 (2022), COBIT 2019 (2023), CISCO Certified Network Associate (2023), and ISO 27001:2013 Fundamental (2023). Currently, he works as Data Center Infrastructure Sub Department Head in one of the State-owned Enterprise in Indonesia.

Imairi Eitiveni is an assistant professor in Faculty of Computer Science Universitas Indonesia. Her main research interests include green IT/IS, ICT for development, information systems, e-government, and e-business. She received her PhD in Computing and Information Systems from the University of Melbourne, Australia. She has published a number of papers in journals and leading conferences in information systems (such as PACIS and ECIS).

Warda Yaziji earned a Bachelor's degree in Computer Science from the University of Indonesia (2012-2016). She is currently employed as a civil servant at the Ministry of Law and Human Rights of the Republic of Indonesia, while pursuing a Master's degree in Information Technology at the University of Indonesia. Her interests include e-government, IT service management, Corporate Information System, Human-Computer Interaction, Data management, and IT governance.

Zahrina Aulia Adriani is a bachelor's degree from the Telkom University (2017-2021) and an ongoing Master's in Information Technology, expected to be completed in 2024. She has interest in corporate information system, risk management, big data analysis, and machine learning.