A RISK ANALYSIS IN ENTERPRISE RESOURCE PLANNING IMPLEMENTATION: AN ERP IMPLEMENTOR'S PERSPECTIVE

Danang Setiawan [1], Suryo Wisnuhadi[2], Iko Tatag Anggoro[3]

[1,2,3]Jurusan Teknik Industri, Fakultas Teknologi Industri, Universitas Islam Indonesia
Jl. Kaliurang km 14.5, Sleman, Yogyakarta 55584
Email: danang.setiawan@uii.ac.id

ABSTRACT

During the ERP system design process, various risks have the potential to disrupt and hinder the ERP implementation project. This paper presents the stages of risk analysis using the HoR (House of Risk) approach. The author uses the project manager as an expert in the field of ERP system implementation. The risk analysis has prioritized three risk causes with three proposed mitigation actions. The three proposed risk mitigation for the implementor perspective are (1) learning independently as a mitigation action against a lack of understanding of concepts and practices, (2) conducting briefings to the implementor team as a mitigation action against not being sure to return to the client, and (3) reorganizing documentation as a mitigation action against unclear documentation.

Keywords: ERP, Enterprise Resource Planning, Risk Analysis, HoR, House of Risk

INTRODUCTION

In a project with limited resources, various risks may occur during a series of activities in the project, hampering or even potentially causing the project to fail. Risk management in project implementation is one of the success factors in achieving the planned outputs and Key Indicator Performance (Yamami, 2017). According to Kim (2020), various variables are the primary concern in planning and implementing risk management in a project, including scope, budget, timeline, communication, stakeholders, etc., that must be appropriately managed so that potential risks can be minimized or even avoided.

This study uses the implementation process carried out by an ERP implementor to one of its clients as a case study. From the implementor's perspective, the research aims to identify and manage risks that can hinder and disrupt the ERP system implementation process. The analysis uses project managers as subjects in risk management because they have an in-depth understanding and practical experience related to risk during ERP implementation. There are five risk management stages, including mapping OPEN-ERP system implementation activities, identification and measurement of risk events, identification and measurement of risk agents, House of Risk (HoR) 1 (House 1), HoR 2 (House 2), and recommendations for mitigation actions.

RESEARCH METHOD

With the HoR approach, risk management consists of two main stages: House 1 and House 2. In House 1, identifying risk events and causes will be prepared to prioritize risk management. Based on the risk priorities obtained, proposed actions will be prepared to handle or mitigate risks in house 2 (Trenggonowati & Pertiwi, 2017). Figure 1 shows details regarding the stages of risk management using the HoR approach.
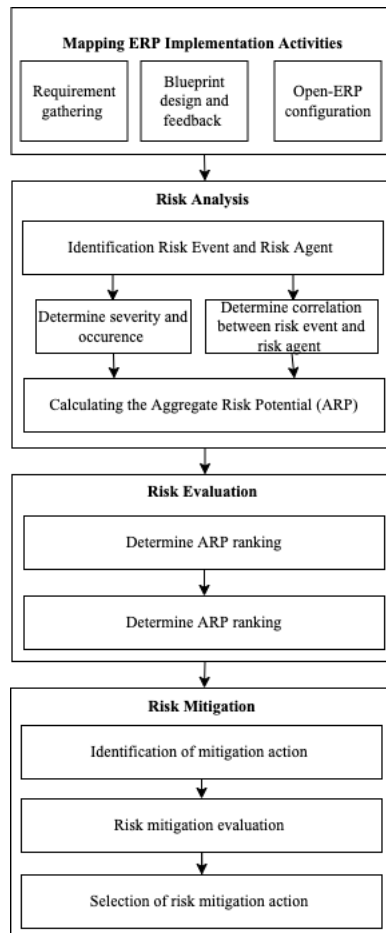
Figure 1. Research method

The explanation of each stage is as follows:

1. **Mapping of ERP System Implementation Activities**

   They are mapping all activities in implementing an OPEN-ERP-based ERP system on one of the company's clients. There are two main activities in designing this system: requirements gathering and blueprint design, with several sub-activities. These two activities and their sub-activities will be analyzed for risk management to avoid risks that have the potential to arise and disrupt the course of system implementation.

2. **Risk Identification**

   Identify risks that potentially occur in the sub-activities of the two main activities. Risk is identified by registering and collecting as many potential risks as possible by observing and interviewing the person responsible for this ERP implementation project, namely the project manager. The risk objects identified at this stage are divided into risk events (potential risk events) and risk agents (cause of risk events).

3. **Risk Analysis**

   After knowing the various risks that have the potential to occur, a risk is analyzed by measuring risk at the House 1 of the HoR approach. Risk measurement is carried out on the identified risk events and risk agents. Risk events are calculated using the severity indicator, which identifies and estimates the level of impact of risk events on the company's operational processes. In contrast, risk causes are measured using the occurrence indicator, which identifies and estimates the probability of occurrence of a cause or source of risk. The project manager carries this measurement subjectively based on his work experience.

4. **Risk Evaluation**

   At this stage, the cause of the risk that requires special treatment will be selected by prioritizing the risk based on the ARP. A high ARP indicates that the risk agent requires special treatment.

5. **Risk Mitigation**

   Identify and analyze various alternative mitigation actions against the risk causes prioritized previously. The project manager will measure the correlation of the causes of risk with various predetermined alternatives.

RESULT AND DISCUSSION

Mapping of ERP System Implementation Activities

The phases considered risky in ERP implementation processes are requirements gathering and blueprint design. Both involve reference documents for future ERP system development, containing all ERP system specifications developed to meet company needs. Suppose the system specifications designed in the blueprint do not follow the company's needs and demands. In that case, it is potential that the system developed later cannot accommodate the client's business and even fail. Therefore, the early phases of ERP system implementation, including requirements gathering and blueprint design, are crucial. Table 1 shows the mapping of activities in the OPEN-ERP system implementation.

Table 1. Mapping of OPEN-ERP system implementation activities

Major Processes	Activities
Requirement gathering	Identification of Needs and Business Processes of the client
	Business Process Socialization on OPEN-ERP Best Practice
	OPEN-ERP Best Practice Recommendations
Blueprint design	Business process analysis at client
	OPEN-ERP Best Practice Analysis
	Gap analysis
	Blueprint design
	Review dan Feedback by the client
	Blueprint finalization
OPEN-ERP System Configuration	General configuration, sales, and purchasing modules

Risk Identification

According to Ummi (2017), risk events or risk events (Ei) are all events that have the potential to occur in a particular process or activity that results in losses to a company. The researcher determines this potential risk event based on the ERP system implementation activities identified previously with consideration and input from the project manager. The project manager understands the end-to-end ERP system implementation project and the risks. A severity scale assesses and estimates the impact (severity) on the company's business processes. The scale used in the severity value is 1 to 10, with the interpretation that one means no disturbance effect occurs, while a value of 10 means that a disturbance effect must occur. The project manager assesses the severity scale value

for this potential risk event and determines it subjectively. Table 3 shows the risk events and the severity scale of the ERP system implementation.

Table 2. Risk event identification

Major Prosses	Activity	Risk Event	(Ei)	Severity
Requirement Gathering	Identification of client's business process	Miss-understanding between implementor team and client team.	E1	9
		Ineffective and un-focus discussion	E2	7
		Lack of information or improper information	E3	9
	Explanation of the Open ERP business process	Improper understanding of Open ERP business process by the implementor team	E4	9
		Lack of attention given by the client team	E5	8
	Best Practice OPEN-ERP recommendation	Errors or bugs happened during the Open ERP demonstration	E6	5
		Improper explanation given by the implementor team	E7	7
		Client's miss-understanding on Open ERP system	E8	7
Blueprint Design	Client business process analysis	Errors in reviewing the client's need and business process	E9	9
	Best practice OPEN-ERP analysis	Errors in reviewing the business process of OPEN-ERP best practice	E10	9
	Gap analysis	Errors in conducting gap analysis, which already included in best practice	E11	9
		Not identified specific client's business processes, which have not been accommodated in the system	E12	9
		Extreme customization of Open ERP Best Practice	E13	9
	Blueprint design	Irrelevant features to the client's business need but are listed on the blueprint	E14	7
		Incomplete blueprint, both in terms of description, objective, scope, and system specification of the ERP system	E15	8
	Review and Feedback from client	Client difficulties in understanding the system specification contained in the blueprint	E16	6
		The length of the review and feedback process by the client	E17	7
		Client feedback is not relevant to the specification contained in the blueprint	E18	6
	Blueprint finalization	Blueprint approval takes a long time	E19	9
OPEN-ERP system configuration	System configuration	Error in some functions or functions cannot be executed	E20	8

Risk Analysis

Risk agents are various factors that potentially cause risk events. The causes of these potential risks are determined by researchers based on risk events with consideration and input from the project manager. An occurrence scale is used to estimate the possibility of a risk source resulting in the occurrence of a risk event. The scale used is 1-10, with the interpretation that a value of 1 means that it rarely occurs, while a value of 10 means it often occurs (Ummi, 2017). The occurrence scale value for this risk agent is assessed and determined subjectively by the project manager. Table 4 shows the risk agent and the scale of occurrence.

Table 3. Risk agent identification

Risk Agent	(Ai)	Occurrence
The implementor team does not conduct re-confirmation of important things.	A1	8
The questions asked are not coherent, and there is no questionnaire as a reference for collecting information from clients.	A2	3
The implementor team is not looking for references or asking the project manager regarding the flow of business processes that have not been understood in OPEN-ERP best practices.	A3	4
There is no checking on the demo system that will be displayed and demonstrated to clients.	A4	7
Submission of OPEN-ERP best practice material that is not clear.	A5	6
Lack of preparation before meeting with clients	A6	4
Lack of understanding and mastery of theory and practice regarding OPEN-ERP best practice.	A7	8
There is no review of OPEN-ERP best practice materials that have been submitted to clients.	A8	4
The explanation of OPEN-ERP best practices is not carried out based on clear stages.	A9	3
The lack of time and opportunity given to clients to understand and ask questions about OPEN-ERP best practices.	A10	4
Not recording or documenting the requirements gathering process with clients.	A11	3
Notes that are not clear and difficult to understand during the requirements gathering process with clients.	A12	8
Lack of understanding of what clients really need and don't need related to the ERP system	A13	5
The blueprints' format, language, and writing are less clear and difficult to understand.	A14	4
Lack of guidance on how to provide feedback on blueprint documents.	A15	4
Does not provide sufficient time for the client to review and provide feedback regarding the blueprint	A16	3
There were no direct discussions on several important matters, for example a custom request that significantly changed the process in OPEN-ERP best practice.	A17	4
Less effective in communicating with the client concerned.	A18	4
Error in configuring the OPEN-ERP system.	A19	4

House of Risk (House 1)

House 1 determines which risk sources are prioritized for risk prevention. The main thing in House 1 is identifying the correlation between risk events and agents (Affifah, 2021). The experts distributed a questionnaire to determine how significant the relationship between each risk event and the risk source is. The relationship between risk agents and risk events is identified and assigned a value of 0, 1, 3, or 9 as a sign of each connection, where 0 indicates no correlation and 1, 3, or 9 means that the correlation is low, medium, and high correlation (Ulfah, 2016). The Aggregate Risk Potentials (ARP) are calculated by multiplying the risk event value with the risk agent. The greater the ARP value indicates that the risk agent must be prioritized. Table 4 shows the selected risk priorities.

Table 4. Selected risk priorities

Risk Event	Risk Agent									
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
E1	9	1						3		
E2	3	9				9				
E3	3	9				9				
E4			9			9	9			
E5		1		1	9	3		3	9	9
E6				9		3				
E7			9		1	9	9			
E8	1		3		9	1	9	9	9	9
E9	9	3	1							
E10			9				9			
E11		1	9				3			
E12	9	3								
E13	1						3			
E14		1								
E15										
E16										
E17										
E18										
E19										
E20			9				9			
Occurrence of Agent	8	3	4	7	6	4	8	4	3	4
ARP	2456	693	1632	371	852	1336	3312	456	405	540
Peringkat	2	11	5	17	8	7	1	14	16	12

Table 5. Selected risk priorities

Risk Event	Risk Agent									Severity of Risk
	A11	A12	A13	A14	A15	A16	A17	A18	A19	
E1							9			9
E2										7
E3							1			9
E4										9
E5										8
E6									3	5
E7										7
E8			1				9			7
E9	1	9	9				9			9
E10										9
E11	1	9	9				3			9
E12	3	9	3							9
E13	3	1	9							9
E14		1	9				3			7
E15			3	9						8
E16				9			3	9		6
E17				9	9			3		7
E18				1	9	9		3		6
E19			3				9	9		9
E20			1						9	8
Occurrence of Agent	3	8	5	4	4	3	4	4	5	
ARP	216	2072	1995	780	468	162	1524	696	435	
Peringkat	18	3	4	9	13	19	6	10	15	

Furthermore, the ARP value of each risk source is displayed through a Pareto diagram to arrange its priorities (Figure 2).
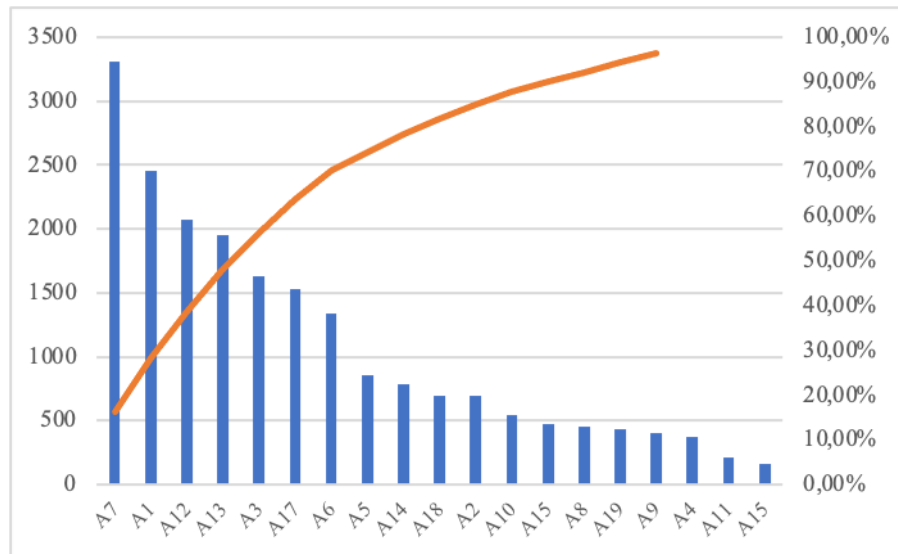
Figure 2. Pareto diagram of ARP value

The Pareto chart shows the order of risk agents based on the ARP value and its cumulative percentage. The risk agent with the largest ARP is the cause of the risk that will be prioritized. In the Pareto diagram, the 80/20 rule is used, which illustrates that 80% of the risk events that arise come from 20% of the risk agents that caused them (Harsita & Amam, 2020). Based on this rule, risk agent A7 is selected with values and percentages respectively 3312 and 16.72% because it is close to 20%. However, the project manager suggested that the other two risk agents with the highest scores (A1 and A12) should also be prioritized because they are considered essential, and the mitigation actions to deal with them are simple. In addition, this risk (A1 and A12) agent is prone to occur and has a negative impact that interferes with the implementation of the system.

House of Risk (House 2)

House 2 in the house of risk method is the process of designing various mitigation actions to give priority to activities that are relevant to risk sources. The initial stage measures the correlation value between the proposed mitigation strategy and previously prioritized risk agents. Table x shows the mitigation actions designed to address the risk agents.

Table 5. Risk Mitigation Recommendation

Mitigation Action	(PAi)
Learn independently related to OPEN-ERP both in theory and practice on the system. If there are difficulties or stagnation, the implementor team can ask the project manager.	PA1
Conducting briefing to the implementation team before meeting with clients.	PA2
Conduct regular training to the implementor team regarding ERP system implementation and procedures for communicating with clients.	PA3
Reorganize the results of notes and documentation of meeting results in a coherent and clear manner including naming the minutes of the file.	PA4
Asking the client to clearly explain the client's business needs and processes during the requirements gathering	PA5

The degree of difficulty of implementing mitigation actions is measured using values of 3, 4, and 5, which coherently interpret mitigation actions that are easy to implement, somewhat difficult to implement, and difficult to implement. After measuring the degree of difficulty and total effectiveness, each risk agent's total effectiveness in implementing mitigation actions (ETDk) is calculated to determine the priority scale from the highest to the lowest value. The company's handling strategy selection can be seen based on the ranking by looking at the ETD value. This mitigation action rating is useful for showing the mitigation strategies that can be applied first. Table 4 shows the results of House 2, along with the priority of mitigation actions.

Table 6. Risk Mitigation Recommendation

	PA1	PA2	PA3	PA4	PA5	ARP
A7	9					948
A1		9	9		1	490
A12		3	3	9	9	360
TeK	8532	5490	5490	3240	3730	
Dk	3	3	4	3	5	
ETD	2.844	1.830	1.373	1.080	746	
Rangking	1	2	4	3	5	

The mitigation actions generated based on the ETD value (total effectiveness of implementing mitigation actions against risk agents) are PA1, PA3, and PA4.

PA1: Study independently related to OPEN-ERP in theory and practice in the system. If there are difficulties, the implementor team should ask the project manager.
PA3: Conduct a briefing to the implementor team before meeting with the client.
PA4: Reorganize the results of the notes and documentation of the meeting results coherently and clearly, including naming the file of the minutes.

Risk Action Mitigation

Three mitigation actions are proposed to address the three priority causes of risk. The three mitigation actions are selected and prioritized through the value of the ETD. On the other hand, the project manager's opinion also influences mitigation action selection. The ranking of the ETD values from the highest to the lowest for each proposed mitigation action is PA1 (2844), PA2 (1830), and PA6 (1080). The project manager agreed with the proposed mitigation actions because they were practical and easy to implement. The following is a description of the mitigation actions to address the prioritized risks:

1 PA1 is a proposed mitigation action to address priority risk A7 (lack of understanding and mastery in theory and practice regarding OPEN-ERP best practice)
2 PA3 is a proposed mitigation action to address priority risk A1 (Not confirmed by asking again about essential things and needs to be emphasized)
3 PA4 is a proposed mitigation action to address risk priorities A12 (Notes that are not clear and difficult to understand during the requirements gathering process with the client)

CONCLUSION

In dealing with risks that may arise during OPEN-ERP system design activities from the implementor team's perspective, the HoR approach is used as a risk management tool oriented toward risk prevention. With the HoR approach, the determination and measurement of activities, potential events, causes of risk, and mitigation actions are based on the opinion of the project manager as an experienced expert. The three reasons for risk are prioritized with three proposed mitigation actions. The three proposed mitigations are:

1. Learning independently as a mitigation action against a lack of understanding of concepts and practices
2. Conducting briefings to the implementor team as a mitigation action against not being sure to return to the client
3. Reorganizing documentation as a mitigation action against unclear documentation

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