The Role of Risk Management on Implementation of Innovation Management System on Research Department

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Abstract. Risk Management is a plan to manage a risk that may occur in an organization. This plan includes risk identification (event, cause, category, source, severity), risk measurement (inherent, existing control, residual, and mitigation), risk mapping and evaluation (probability and impact), and risk monitoring plan. In this research, we would like to analyze the role of risk management to support the implementation of innovation management system (ISO 56002:2019) on research organization. Based on statistic of risk register on 2022, we collect 26 risk event, that classify into several type like partnership, HSSE, software, contract, and research. Then, almost 42% of risk events are qualify on HSSE/HIRADC standard system, to apply the implementation of this ISO, the risk event should have a larger proportion to cover all research activity such as basic theorytical, prototype, validation on field/real condition, and implementation. So that, the risk management process in research activities can run optimally.

Keywords: risk management, research, organization, innovation management system, risk proportion.

1 Introduction

Risk is an uncertainty that occurs and events that are not expected to occur. In the research and innovation department, risks often occur because research creates something new and has not been applied to actual conditions. For this reason, in its implementation, the preparation of the risk register must be carried out in an organized manner and cover all aspects that allow risks to occur so that risk managers can determine risk mitigation strategies and determine the person responsible if the risk occurs. . In this research, based on the results of the External Audit to obtain Innovation Management System Certification (ISO 56002:2019), determining the risk register is an important aspect in managing risks such as risk events, risk categories, risk sources, severity levels, risk

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owners, mitigation methods, reduction risks, to the adequacy of control tools to mitigate risks so that research activities in the Research, Technology and Technology Innovation Department can run according to the desired controls.

2 Theory

2.1 Risk Identification

Risk identification as the process of identifying potential risk factors. Therefore, for an risk event to be categorized into the risk identification phase, the risk event needs to focus on identifying potential risks in the given context of the risk event[5].

All possible risks that may arise are collected by the risk management team. Some ways that can be done in this stage are [2]:

- Brainstorming is gathering together and collecting all existing thoughts about the risks that might occur.
- Expert Judgment is using the expert services to collect information about the risks that may arise during project.
- Questionnaires is namely distributing questions to all stakeholders (all parties involved in the project) to provide input about the risks that may arise.
- Risk Management Evaluation is looking at data from risk management of similar or similar projects that have been carried out by other companies or companies as a reference.

2.2 Risk Measurement

Risk Assesment is the process through which the probability or frequency of a loss by or to an engineering system is estimated and the magnitude of the loss (consequence) is also measured or estimated[7]. In determining the measurement of a risk, there are 3 aspects that can be done to get a risk value, namely:

- Hazard Identification includes identification of assets such as buildings, information technology, utility systems, machinery, raw materials and finished goods. The potential for environmental impact should also be considered. Consider the impact an incident could have on your relationships with customers, the surrounding community and other stakeholders. Consider situations that would cause customers to lose confidence in your organization and its products or services
- Vulnerability as you conduct the risk assessment, look for vulnerabilities—weaknesses—that would make an asset more susceptible to damage from a hazard. Vulnerabilities include deficiencies in building construction, process systems, security, protection systems and loss prevention programs. They contribute to the severity of damage when an incident occurs. For example, a building without a fire sprinkler system could burn to the ground while a building with a properly designed, installed and maintained fire sprinkler system would suffer limited fire damage.
- The impacts from hazards can be reduced by investing in mitigation. If there is a potential for significant impacts, then creating a mitigation strategy should be a high priority

Risk Probability / Likelihood (P) is how likely is the risk will occur during the course of the project. In the Qualitative Risk Analysis applied to the research department, the probability level is divided into 5 scales which can be seen in **Table 1** below[6] [10]:

Table 1. Probability Scale Qualitative Risk Analysis on Research Department

Probability Scale	Probability level	Range	Mean
1	Rare	$0 < x \leq 20\%$	10%
2	Unlikely	$20\% < x \leq 40\%$	30%
3	Moderate	$40\% < x \leq 60\%$	50%
4	Likely	$60\% < x \leq 80\%$	70%
5	Almost Certain	$80\% < x \leq 100\%$	90%

Risk Impact (I) is an explanation of the impact resulting from the risks that occur during the project. In Qualitative Risk Analysis applied to the research department, the impact level can be sorted in 5 scales based on financial which can be seen on **Table 2** below[6] [10]:

Table 2. Impact Scale Based on Financial (BTR) on Research Department

Impact Scale	Impact level	Financial
1	Insignificant	$x < 20\%$ of BTR
2	Minor	$20\% < x \leq 40\%$ of BTR
3	Moderate	$40\% < x \leq 60\%$ of BTR
4	Significant	$60\% < x \leq 80\%$ of BTR
5	Catastrophic	$80\% < x \leq 100\%$ of BTR

2.3 Risk Mapping & Evaluation

Qualitative Risk Analysis is perhaps the most widely use one, just because it is simple and quick to perform. In this type, the potential loss is qualitatively estimated using linguistic scale such as low, medium, and high. In this type of analysis, a matrix is formed which characterizes risk in form of the frequency (or likelihood) of the loss versus potential magnitudes (amount) of the loss in qualitatives scales. The matrix is then used to make policy and risk management decision. Because this type of analysis does not need to rely on actual data and probabilistic treatment of such data, the analysis is far simpler and easier to use and understand, but it extremely subjective. Qualitative risk analysis is the method of choice for very simple systems such as a single product safety, simple physical security, and straightforward processes[7].

Inherent Risk measures the auditor's assessment of the possibility that there may be material misstatements (both fraud and errors) in an audit section before considering the effectiveness of the client's internal controls. Inherent risk includes a determination of account balances or classes of transactions against a material misstatement, assuming that there are no policies and procedures related to the internal control structure[8].

Control risk is a material misstatement that can occur if an assertion cannot be prevented or detected on a timely basis by the client's internal control structure. Control risk is a measure of the auditor's assessment of the likelihood that there may be misstatements in an audit segment that exceed tolerable limits, which were not detected or prevented by the client's internal control structure[8].

Residual Risk is the risk that remains after mitigating the risks that may occur. In project management, it is important to identify any risks that have the potential to derail the project. Efforts must be taken to reduce these risks, including controlling controls, eliminating the risk, or reducing the impact of the risk.

2.4 Risk Monitoring

Risk monitoring involves periodic or continuous action to validate currently known risk sources, identify new risk sources (whether due to external threats or internal environmental changes), and verifying the implementation or validating the effectiveness of courses of action chosen as part of risk response[3].

3 Discussion

Risk Analysis as having three core elements of risk assesment, risk management, and risk communication. Risk Management is the process through which the potential (likelihood or frequency) of magnitude and contributors to risk are estimated, evaluated, minimized and controlled[7]. Risk Communication is the process though which information about the nature of risk (expected loss) and consequences, risk assesment approach, and risk management option are exchanged, share, and discuss between the decision makers and other stakeholder[7].

The Research Department, in the process of ISO 56002:2019 innovation management system certification, requires a risk register which is part of the planning for implementing the system. Based on risk register data on 2022, we collect 26 risk event from 6 group research, that classify into several type such as partnership, HSSE, software, contract, and research. From the classification results, 1 risk event was found in the partnership group (4%), 11 risk events in the HSSE group (42%), 2 risk events in the software group (8%), 5 risk events in the contract group (19%), and 7 risk events in the research group (27%). The proportion of risk event can be seen on **Figure 1** below.

Fig. 1. Risk Event Classification Diagram from Risk Register Research Department on 2022.

Comparison of the proportion between risk event on HSSE (**Table 3**) which is larger than risk event on Research (**Table 4**) is contrary to the Innovation Management System (ISO 56002: 2019), where in the implementation process, the proportion of risk events related to research must be greater than the proportion of other risk events. If you look at the cases that occurred in 2019, this HSSE proportion is suitable for implementation in the HIRADC system at ISO 45001:2018.

Table 3. Risk Event on HSSE Classification

No	Risk Event	Classification
1	Potential failure to identify Work Safety Aspects	HSSE
2	Occurrence of Work Accidents resulting in injuries or fatalities in project activities.	HSSE
3	Project implementation has been hampered or postponed due to the COVID-19 pandemic	HSSE
4	Delays and damage to fluid and/or rock samples during the shipping process	HSSE

5	HSE incident during laboratory testing	HSSE
6	HSE incidents on the Field/Rig during a Field Visit or Pilot Project	HSSE
7	Potential Social and Security Conflicts with local communities	HSSE
8	Risk of Failure Minimizing Environmental Aspects in Equipment Testing in the Field	HSSE
9	Risk of Occupational Accident during Field Data Acquisition	HSSE
10	HSE Incident during testing in the Laboratory	HSSE
11	HSE Incident in the Field during a Field Visit or Pilot Project	HSSE

Table 4. Risk Event on Research Classification

No	Risk Event	Classification
1	The risk of failure in creating process innovation	Research
2	The output of work or equipment is not according to plan and/or cannot function properly	Research
3	There is no budget for work outside the RK	Research
4	Work is not in accordance with the timeline, budget, quality, and scope	Research
5	Laboratory test work, field data collection was completed late and did not match the scope of work	Research
6	There is a potential for delays in research activities that need to be carried out abroad due to the country's lockdown policy due to the COVID-19 pandemic	Research
7	Potential Risks When Research Implementation is Not As Planned / Delays Occur	Research

Then, on Research Department, we use a Qualitative Risk Analysis to manage risk event where based on risk event above, risk are identified based on:

- Risk ID department : The numbering of risk events is based on the provisions in force in the
- Function : Function responsible for risk events
- Risk Event : Risk events identified based on existing business processes
- Risk Cause : The cause of the occurrence of risks that can cause the event
- Risk Type : Groups and types of risk
- Risk Indicator : Symptoms shown that could pose a risk

The example of risk identification can be show on **Figure 2** below:

Risk ID		Risk Identification			
	Function	Risk Event	Risk Cause	Risk Type	Risk Indicator
URTI-04	Carbon Capture	The risk of failure in creating process innovation	Research results are not as planned so they do not meet the standards of updating	Governance, Compliance, and Legal - Legal - Intelectual Property (IP)	Found scientific publications and patents on similar topics

Fig. 2. Risk Event Identification

After the risk event can be identified, the next step is to measure the risk which will be divided into 3 stages, namely risk analysis, risk treatment, and residual risk. On Risk Analysis, several parameter can be filled such as:

- Existing Control mitigation the risk : Positive Factors or Controls that exist from risks before
- Impact Category : Impact classified includes qualitative or quantitative
- Impact Description is not carried out : Explanation of the impact of risks that occur if the control
- Inherent Quantitative Impact that occurs : The magnitude of the impact value resulting from the risk
- Inherent Impact Scale : The level of impact resulting from the risk occurring
- Inherent Probability Scale : The level of probability that the risk will occur
- Risk Priority Number (RPN) probability and impact : The value resulting from the multiplication between

The example of risk measurement (step risk analysis) can be show on **Figure 3** below:

Risk Analysis						
Existing Control	Impact Category	Impact Description	Inherent Quantitative Impact (000 USD)	Inherent Impact Scale	Inherent Probability Scale	Risk Priority Number (RPN)
Research Department has a QSKM function that manages intellectual property	Kualitatif	Does not produce scientific publications and research patents	50	2	3	6

Fig. 3. Risk Measurement or Assesment : Analysis

After we measure the risk and plan to treatment the risk, then we plot all the risk event on risk matrix[1][4] (**Figure 4**) below :

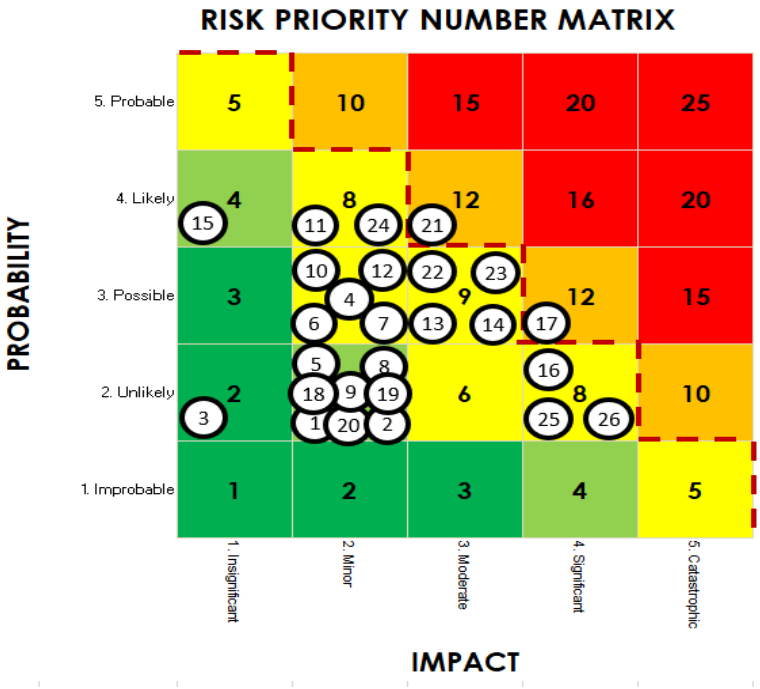

Fig. 4. Risk Matrix for Risk Event on Research Department

Then Risk Treatment (see **Figure 5**), several parameter can be filled such as:

- Risk Treatment Option : Steps taken to control risks such as[9] retain, reduce, mitigate, sharing, and avoid

1-3	Low	Retain
4	Low to Moderate	Reduce/Mitigate or Retain
5-9	Moderate	Reduce/Mitigate
10-12	Moderate to High	Sharing or Reduce/Mitigate
15-20	High	
25	High	Avoid or Reduce

- Risk Treatment Activities : Activities undertaken to control the risk
- Risk Treatment Cost : Cost incurred to control the risk

And the last, the Residual Risk step (see **Figure 5**), several parameter can be filled such as:

- Residual Quantitative Impact : The magnitude of the impact value resulting after mitigation
- Residual Impact Scale : The level of impact resulting after mitigation
- Residual Probability Scale : The level of probability that the risk after mitigation
- Risk Priority Number (RPN) : The value resulting from the multiplication between probability and impact

Risk Treatment			Residual Risk			
Risk Treatment Option	**Risk Treatment Activities**	**Risk Treatment Cost (000 USD)**	**Residual Quantitative Impact (000 USD)**	**Residual Impact Scale**	**Residual Probability Scale**	**Risk Priority Number (RPN)**
Reduce/Mitigate	1. Participate in conferences on the latest research developments 2. Sharing knowledge between workers	20	-	1	3	3

Fig. 5. Risk Measurement or Assesment : Treatment and Residual

After mitigate the Risk, Risk Priority Number of Residual Risk then be plotted on Residual Risk Matrix[1][4] (can be seen on **Figure 6**) below :

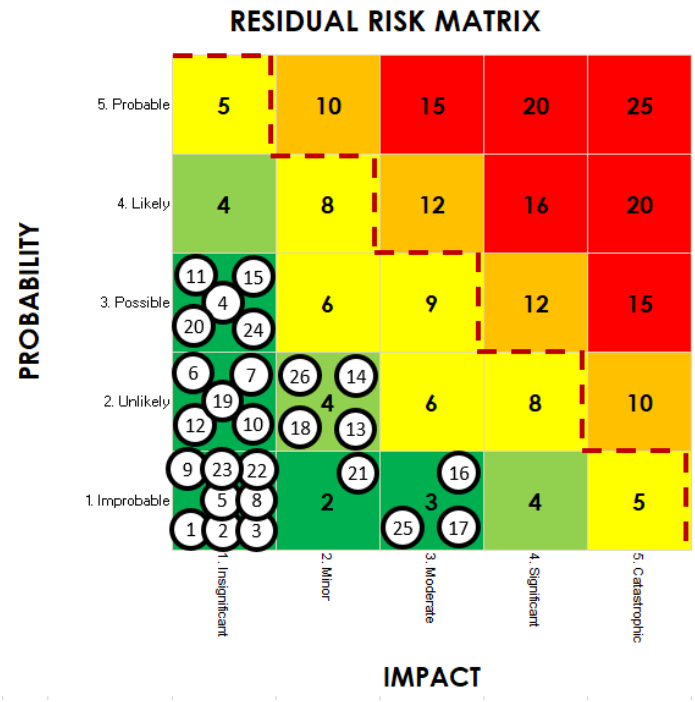

Fig. 6. Risk Matrix for Risk Residual on Research Department

If we have prepared a plan for managing risk, then the research department will monitor risk management as shown in the example in **Figure 7** below.

NO	RISK EVENT	MITIGATION PLAN	REALIZATION OF MITIGATE THE RISK												EVIDENCE	PIC/Risk Owner
			TW I			TW II			TW III			TW IV				
			JAN	FEB	MAR	APR	MEI	JUN	JUL	AGU	SEPT	OKT	NOV	DES		
1	The risk of failure in creating process innovation	Participate in conference on the latest research developments													1. Evidence of Delegation's Attendance in Benchmarking Technology at the Conference 2. Report on the Results of Transfer of Knowledge on the Conference Agenda	Geothermal Research
		Sharing Knowledge between workers													1. Proof of Screenshots/Attendance List/Photos of Worker Sharing Session Activities 2. Material / MoM resulting from the Worker's Sharing	Geothermal Research

Fig. 7. Risk Monitoring Procedure

Implementation of the Innovation Management System (ISO 56002:2019), the risk event should have a larger proportion to cover all research activity such as basic theorytical, prototype, validation on field or real condition, and implementation. So that, the risk management process in research activities can run optimally.

4 Conclusion

The conclusion derived from this paper are:

1. Based on risk register data in Research Department on 2022, we collect 26 risk event from 6 group research, that classify into several type such as partnership (4%), HSSE (42%), software (8%), contract (19%), and research (27%).
2. The proportion of risk event on research is smaller than risk event on HSSE that is contrary to implementation of Innovation Management System (ISO 56002: 2019).
3. To apply the Innovation Management System (ISO 56002:2019), risk event must cover all research activities such as basic theorytical, prototype, validation on field or real condition, and pilot plant so that the role of risk management in research activities will run optimally.

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