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MANAGING RISK OF REFINERY MEGAPROJECT BASED ON ISO 31000 AND PMBOK

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Abstract

In order to improve national energy security and the competitiveness of the refinery industry, PT Pertamina (Persero) implements the Refinery Development Master Plan (RDMP), which is revamping 4 units of existing refineries and building 2 units of new grass root refinery. In this paper we will discuss risk management for the RDMP project based PMBOK and ISO 31000 RDMP.

RDMP Project management is divided into two stages, namely project development and project execution, risk management has been implemented since the project initiation until commissioning startup. The process of risk management referring to PMBOK are plan risk management, identify risks, qualitative risk analysis, quantitative risk analysis, plan risk responses, implement risk responses and monitor risks. We determined risk limit for project 5% of investment costs, while the ongoing stage is 5% of the current year's budget, those number represented Pertamina's risk appetite. Furthermore, the risk identification stage followed by qualitative risk analysis obtained 170 risk events with 46% in the categories of strategy & planning aspect, 2% compliance aspect and the remaining 22% operations / infrastructure aspect. This is in line with the theory that stated at the project development stage having higher risk than at the execution stage, and the top risk category is related to business strategy risk, namely the business scheme (tolling or merchant), getting the right partner, project financing, land acquisition, most of the top risk are risk owned by Project Development Department.

The quantitative risk analysis (QRA) stage has two tasks, namely numerical simulation of project economics and numerical simulation of cost & schedule. Once of the overall project risks can be seen from the QRA results, probability of completed project duration P80 for RDMP Balikpapan project is 58 months while P50 is 57 months and P90 is 59 months.

To assess the effectiveness of risk management and project management, a maturity assessment has been carried out with results of level 2.65 of scale 5 for project management and 3.3 of scale 5 for project risk management.

When implementing project risk management, we use for both PMBOK and also ISO 31000 frame work, this feels very complementary. As an example the need for risk maturity as a review of risk management implementation, mandate & commitment and the existence of a Risk Management Policy, the principles and risk management framework of ISO 31000 are very beneficial. On the other hand, emphasizing positive and negative risks, links with the knowledge areas and other process groups by PMBOK are very helpful in integrating project risk. When conducting risk management Pertamina equipped with web-based Enterprise Risk Management System (ERMS) to facilitate data and communication processes.

From the discussion it can be concluded that ISO 31000 and PMBOK complement each other in carrying out project risk management, quantitative risk analysis can describe overall risk of the project, maturity assessment helps measuring the effectiveness of risk management and gap analysis, risk management information system is very necessary in carrying out risk management

Key words : RDMP, QRA, maturity assessment, overall risk, tolling, merchant, ISO 31000, PMBOK
JEL code: O22

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Introduction

Refinery and Petrochemical Megaproject PT Pertamina (Persero) aims to increase refinery capacity from 1 million barrels per day to 2 million barrels per day, the project consists of revamping Cilacap refinery, Balikpapan refinery, Balongan refinery, Dumai refinery and building of new refineries in Tuban and Bontang. Project risk management is carried out since the initial stage of project development to the end of project execution. As a reference for project risk management generally refers to the PMBOK framework, but this has limitations where risk management starts after the project charter, while our megaprojects have been exposed risk since pre project stage.

The project development stage (before project charter) and early work scope of megaproject have been exposed to major risks including business decisions risk, project financing risk, establishment of subsidiaries risk, land acquisition and site preparation risk. It takes 2 to 3 years before the EPC contract starts where hundreds of millions of dollars have been spent for pre project work. Our experience with reference to the ISO 31000 standard and the combination with the PMBOK standard as a reference for risk management provides complementary benefits so that project risks before and after the charter project can be managed according to standards.

In this paper I will explain how Pertamina takes a combination of principles, frameworks and process from ISO 31000 combine with process taken from PMBOK that can complement each other so that megaproject risk management can be carried out effectively and efficiently.

Risk Management at Pertamina

PT Pertamina (Persero) is an integrated oil and gas state-owned company from the upstream, downstream and midstream sectors, we have 11 directorates one of them is the directorate of refinery and petrochemical megaprojects. As an integrated corporation we use the basis of ISO 31000 standards as a reference for implementing risk management for companies and subsidiaries and specifically for the megaproject directorate because using PMBOK as a reference for project management implementation, our project risk management also refers to the risk management came from PMBOK risk management framework.

Refinery & Petrochemical Megaproject Risk Management Process

The business process of Refinery and Petrochemical megaproject is described in figure 1 below, the scope of risk management starts from the initiation of the project to the start-up and commissioning. Project charter is created after the approval of Final Investment Decision (FID) and in accordance with the PMBOK the project lifecycle starts after the pre-project work is completed as depicted from figure 2. As seen from figure 1 we have actually carried out risk management since Pre-Feasibility Study (Pre-FS) work, it was not like the project PMBOK lifecycle stated where risk management is done after the project charter. By adopting ISO 31000 we have a reference when implementing the risk management at project development stage. For refinery and petrochemical megaprojects, during project development phase there has been a high risk exposure. For example, we have spent around US $ 500 million in the project development stage while FID is not approved yet, the development stage can take 2 to 3 years' duration. During project development stage or pre project work our risk exposure is high that's why requirement of doing risk management is mandatory, here is the role of ISO 31000 work. We carry out risk management with scope of strategic risk regarding project proposals and with the context as a state owned company obeyed to the minister of state owned enterprise

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regulation No.PER-01 / MBU / 2011 regarding the Implementation of Good Corporate Governance in State Owned Enterprises (scope, context, ISO 31000 risk management process criteria).

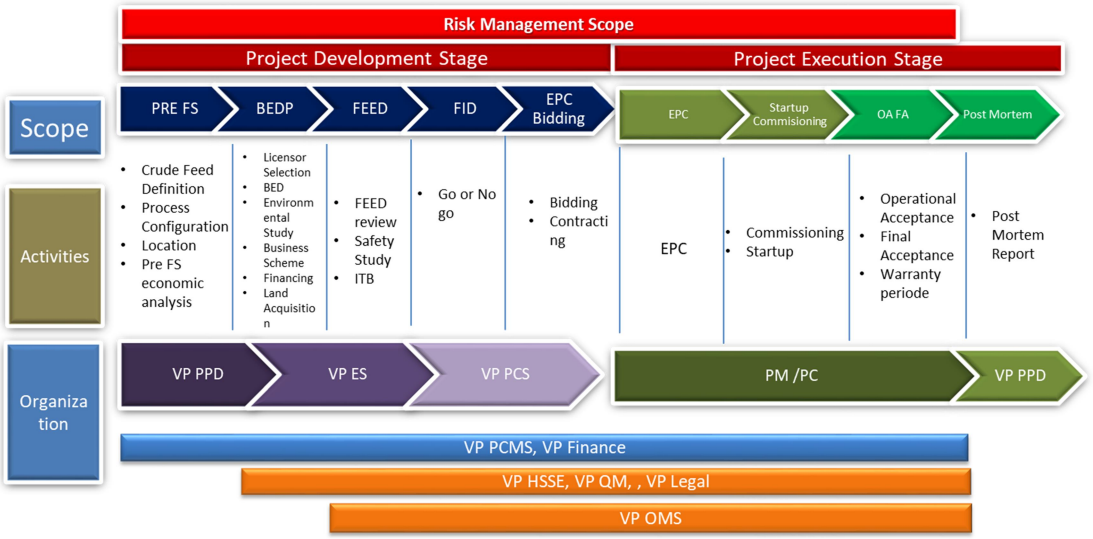

Fig. 1 **Megaproject business process**

Source: Author construction

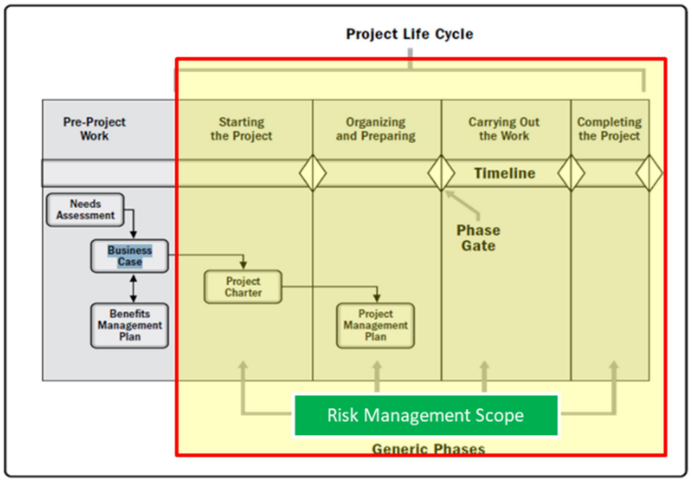

Fig. 2 **Project Life Cycle ref PMBOK 6th edition**

Source: Author construction

ISO 31000 and PMBOK a complementary perspective

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According our experience of how the two standards above complement each other for more details can be seen in figure 3 below.

Table 1

Risk for Megaproject, ISO 31000 and PMBOK

	Proses	Activities	PMBOK	ISO 31000
PRE PROJECT WORK		Established Risk Management Policy		Leadership & commitment 5.2
		Project Risk Organization (assignment letter)		Leadership & commitment 5.2
		determine Risk Tolerance		Scope, context, criteria
		Pre Feasibility Study	Project Management Business Document	
		(risk register with scope high	High Level Risk Register	
		level risk and overall project risk)	Overall Project Risk	
		Quantitative risk analysis (economic analysis)		
		Determine contingency and management reserve	Known unknown risk and unkwon unknown risk	NA
		Final Investment Decision (FID)	Project Success Measures (targeted NPV, IRR, PBP)	
PROJECT LIFECYCLE	INITIATING	High level Project risk for Project Charter	**Project Charter**	NA
	PLANNING	Risk Management Plan (appetite, risk criteria, risk tolerance included)	Plan Risk Management	Scope, context, criteria
		Road Map Risk Management		Leadership & commitment 5.2
		Risk register	Identify Risk	Risk identification
		Qualitative risk analysis	Qualitative risk analysis	Risk analysis
		Schedule & Cost Quantitative Risk Analysis	Quantitative risk analysis	Risk analysis
		Risk ranking, risk strategies, risk owner	Plan risk responses (strategy for threat & strategy for opportunities, escalate)	Risk evaluation (Strategy for negative risk)
			Fallback plan & contingency plan	NA
	EXECUTING	Execute risk responses/risk treatment by PIC Risk	Implement Risk Responses	Risk Treatment
	MONITORING & CONTROLLING	Weekly meeting, Project Risk Forum, monthly report	Monitor Risk	Recording & Reporting
			Reserve analysis	NA
		Risk Maturity Assessment	Risk Audit	Monitoring & review

Source: Author construction

The principles, framework and process at ISO 31000 are very useful in managing project risk management, this can be said that the risk management process in PMBOK can also be done effectively with the support from of ISO 31000 principles & framework as illustrated in figure 3. From table 1 the first step in our risk management process is to establish policy, organization, risk tolerance, those are the realization of the ISO 31000 framework where PMBOK does not state it. Furthermore, determining the list of high-level risks for overall project risk, risk and reserves is the realization of the PMBOK project risk management in which ISO 31000 does not mention. Then creating the risk management plan, road map, cost & schedule risk, risk ranking, determination of the risk owner and risk response strategies, are a realization from ISO 31000 and PMBOK even though in different terms. To measure the effectiveness of risk management we have carried out risk maturity assessment, the basis of its implementation refers to the clauses of PMBOK and ISO 31000 as in table 1 above. And of course what is not in ISO 31000 but in the PMBOK risk management framework stated is the relationship between project risk management knowledge area and other knowledge area from project management.

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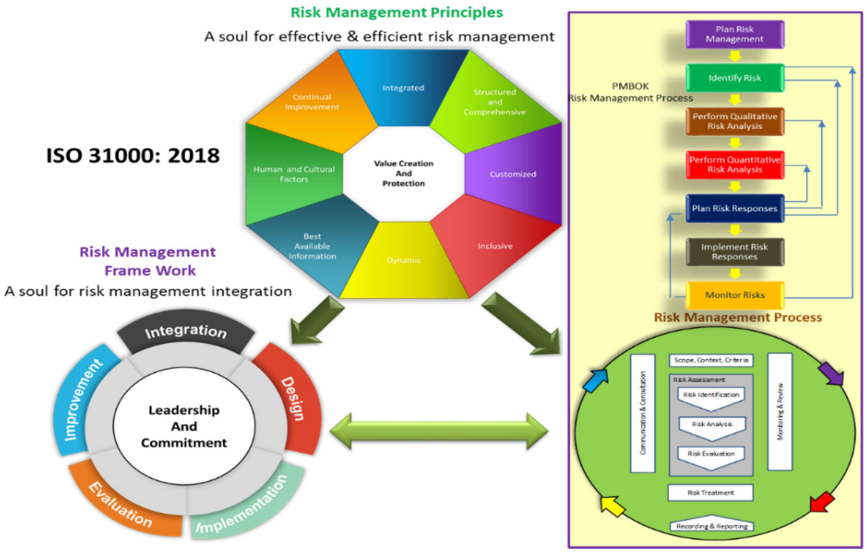

Fig. 3. **A Complementary Risk Management between ISO 31000 and PMBOK**
Source: Author construction

Result

As a result, we present the results of the 2019 risk assessment with a risk tolerance of 5% for the current year budget. The risk identification stage was followed by a qualitative risk analysis obtained 170 risk events with composition of risk 46% in the category of strategy & planning aspect, 2% compliance / infrastructure aspect as depicted at figure 4 and table 2.

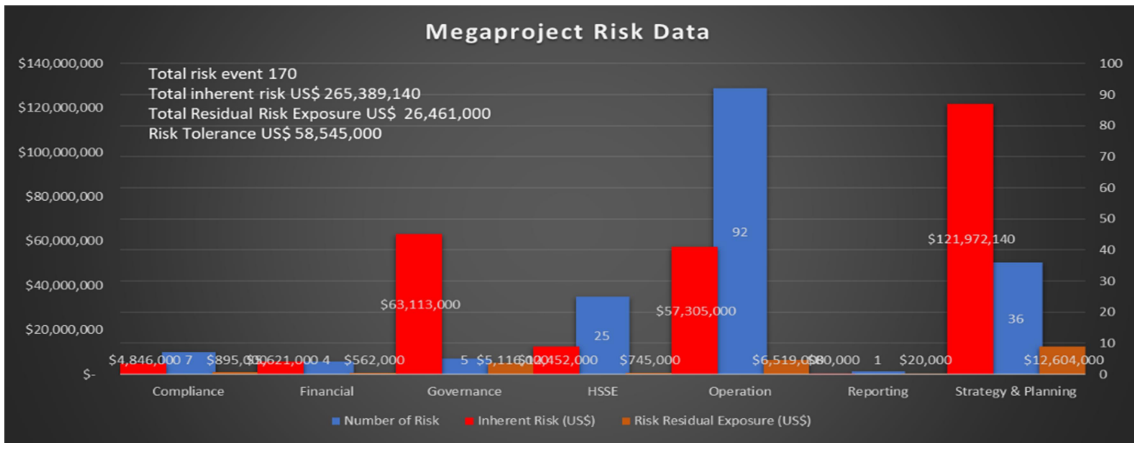

Fig. 4. **Risk Register Data of Pertamina Megaproject**
Source: Author construction

Table 2.

Risk Register Summary

Risk Type	Number of Risk	% Number	Inherent Risk (US$)	inherent %	RRE (US$)	RRE %
Compliance	7	4%	$ 4,846,000	2%	$ 895,000	3%
Financial	4	2%	$ 5,621,000	2%	$ 562,000	2%
Governance	5	3%	$ 63,113,000	24%	$ 5,116,000	19%
HSSE	25	15%	$ 12,452,000	5%	$ 745,000	3%
Operation	92	54%	$ 57,305,000	22%	$ 6,519,000	25%
Reporting	1	1%	$ 80,000	0%	$ 20,000	0%
Strategy & Planning	36	21%	$ 121,972,140	46%	$ 12,604,000	48%
Total	170		$ 265,389,140	100%	$ 26,461,000	100%

Note : RRE = Risk Residual Exposure
Source: Author construction

Strategic & Planning risk is the dominant contributor to the risk register even though the number of risk events is only 21% of the total number of risk events but the inherent risk value is 46% of the value of total inherent risk. This is consistent with the theory that when the project development stage has a higher risk or uncertainty than when project execution, by carrying out risk management since the pre-project or project development stage where having higher risk, so the overall risk of the project can be managed accordingly and ISO 31000 can be used to complement those requirements.

One of the tools and techniques mentioned in PMBOK is the project information system (clause 11.6), where in implementing the risk response will greatly assist by the availability of the application system. Pertamina uses application namely Enterprise Risk Management System (ERMS) to input data, process data, generate risk report and integrate with other application systems.

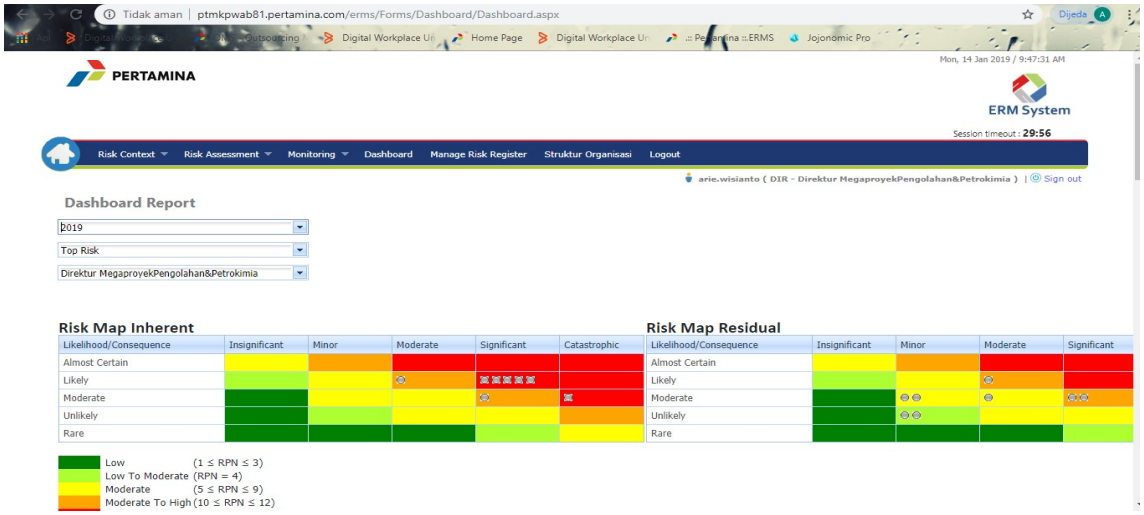

Fig. 5. **Pertamina Enterprise Risk Management System (ERMS)**
Source: Author construction

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As said both by ISO31000 and PMBOK conducting an evaluation of the effectiveness of risk management is necessary, in this case we have done the risk management maturity assessment. In PMBOK stated on Monitoring & Control about risk audit while in ISO 31000 stated in monitoring and review clause Maturity assessment is done by one on one interview for the vice president level and higher while the manager level and below through online surveys (figure 6). The final results of our maturity assessment are at level 3.3 (defined) as depicted on table 3, namely the level at which an organization recognizes the importance of project risk management, and evidence of recognition is reflected in awareness and organizational culture, the existence of a process to apply, and the experience and leadership style in managing project risk.

Table 3

Hasil Maturity Assessment

MATURITY LEVEL				
LEVEL 1 INITIAL	LEVEL 2 REPEATABLE	LEVEL 3 DEFINED	LEVEL 4 MANAGED	LEVEL 5 OPTIMIZING

ATTRIBUTES
PROCESS
CULTURE
EXPERIENCE
APPLICATION
LEADERSHIP

	AREA	SCORE	LEVEL
1	PROCESS	3.45	DEFINED
2	CULTURE	3.34	DEFINED
3	EXPERIENCE	3.18	DEFINED
4	IMPLEMENTATION	3.00	DEFINED
5	LEADERSHIP	3.52	DEFINED
	MATURITY LEVEL	3.30	DEFINED

Source: Author construction

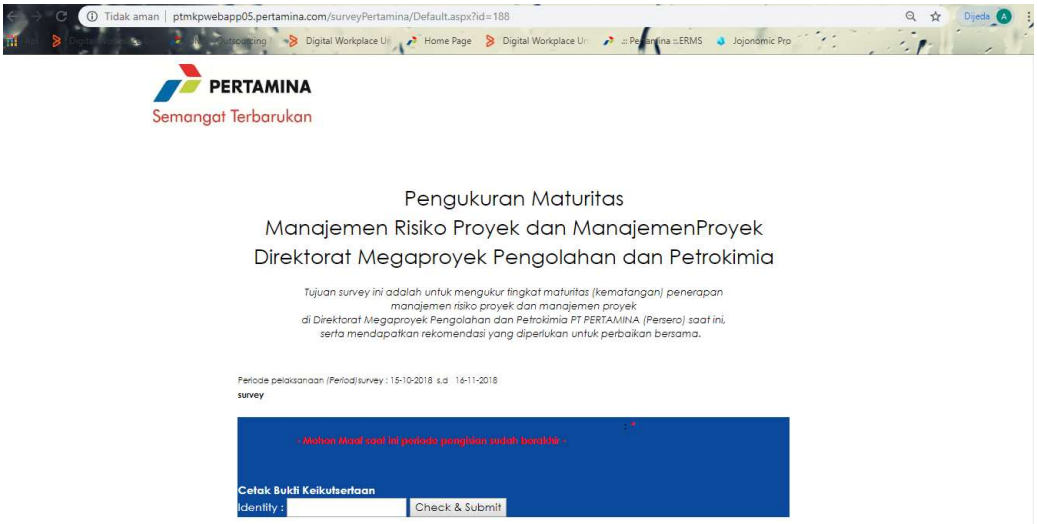

Fig. 6. **Pertamina Online Project Risk Maturity Assessment**
Source: Author construction

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Conclusions

The refinery and petrochemical megaprojects of PT. Pertamina has a high risk process, especially during the project development stage, in this pre-project stage the PMBOK project risk has not been able to be used as a reference for carrying out risk management while the risk level for this stage has been high.

Implementing the PMBOK-based project risk management process is not enough to become the basis and reference in the day-to-day process, the 2018 edition of ISO 31000 can complement these shortcomings so that the risk management process can be more perfectly implemented

The existence of the principles concept and framework in ISO 31000 can encourage the risk management process in both ISO 31000 and PMBOK more effectively and efficiently

The summary of the risk register shows that risk type of risk strategy and planning is the biggest contributor to the risk of the Megaproject Directorate, this also indicates that at the initial stage of the project (pre project / project development) have a higher risk. Risk management should have been carried out since the initial stages of the project

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