Risk Mitigation on Asphalt Mixing Plant Process in Bali

AAA Made Cahaya Wardani[1*], I Nyoman Arya Thanaya[2], I Nyoman Yudha Astana[3], AA Gde Agung Yana[4]

[1]Student of Doctoral Program Engineering Science Udayana University,Denpasar,Bali, Indonesia
[2,3,4] Lecture of Doctoral Program Engineering Science Udayana University, Denpasar, Bali,Indonesia
[*]agungcahaya@unhi.ac.id

Abstract The need for asphalt to meet the handling of the National road project which has been fulfilled by Pertamina as a partner providing asphalt is believed to be able to meet the needs of up to 45 to 50 percent (1.2 million to 1.4 million tons per year). In Bali Province, with a length of 629.39 km of National Roads and 743.34 km of Provincial Roads (PUPR Office of Bali Province, 2018). For Fiscal Year 2018, the need for Asphalt in Routine Rehabilitation / Maintenance Activities for Roads and Bridges is 25,842 tons of asphalt (PUPR Bali Prov. 2018) and the quantity requirement for asphalt for Road and Bridge Improvement Work Packages in Fiscal Year 2018 is 195,657.6 tons.

This study focus on the second stage of risk mitigation that is data collection regarding ISM mitigation and assessment through Focus Group Discussions which will be held after the first stage is completed, the selection of FGD members is carried out by people who have expertise and competence in their fields consisting of: Contractors, Consultants, project owners, academics and competent people in AMP management. From the study found 80 points of mitigation from major risk based on SIPOC stage of asphalt production. This risk mitigation is elaborated into Total Quality Management, and catagorized into 11 category of risk mitigation elements of Risk Mitigation Model based on Total Quality Management.

***Index Terms*— Risk Mitigation, Interpretive Structural Model, Focus Group Discussion**

I. INTRODUCTION

The need for asphalt to meet the handling of the National road project which has been fulfilled by Pertamina as a partner providing asphalt is believed to be able to meet the needs of up to 45 to 50 percent (1.2 million to 1.4 million tons per year). In Bali Province, with a length of 629.39 km of National Roads and 743.34 km of Provincial Roads (PUPR Office of Bali Province, 2018). For Fiscal Year 2018, the need for Asphalt in Routine Rehabilitation / Maintenance Activities for Roads and Bridges is 25,842 tons of asphalt (PUPR Bali Prov. 2018) and the quantity requirement for asphalt for Road and Bridge Improvement Work Packages in Fiscal Year 2018 is 195,657.6 tons. So that the risk of asphalt procurement by its suppliers requires effective handling [1].

The risks that occur in the supply chain of road works projects can of course have an impact on project performance, especially in road infrastructure projects in Bali Province, because road construction projects are a public need, so good supply chain handling and management from upstream to downstream is needed. Project performance related to this supply chain is increased costs, long completion times and decreased project quality [2].

One of the risk issues related to the supply chain risk in the procurement of hot asphalt mixtures is an external risk, namely the closure of the unauthorized C excavation in Selat Village, Karangasem, Bali Province according to Law No. 23/2014. to the quantity of hot asphalt mixture production and reduce the Regional Original Income (PAD) against C excavation [3]. Other risks faced by the mix asphalt supply chain are the risk of demand accumulating over the same period, risk of equipment failure, transportation risk, stock availability risk, weather risk, operational risk, financial risk, quality, etc. All of the things mentioned above are risks that may occur in the supply chain that affect project performance.

This study focuses on mitigating major risks that occur in the road works supply chain, namely identifying risk mitigation in the production and operational processes of the Asphalt Mixing Plant (AMP) production unit related to road infrastructure construction work in Bali Province. Risk mitigation in the supply chain of road infrastructure works in Bali Province, namely the AMP unit, has not been handled comprehensively. Therefore, to obtain a strong supply chain it is necessary to mitigate risks in a structured, systematic and organized manner. In this study, the major risks that occur in the AMP supply chain will be analyzed, then the major risks

are analyzed using the Value at Risk method through a questionnaire, to determine mitigation efforts for major risks in AMP supply chain activities. The novelty of this research is that risk mitigation efforts in the supply chain are complex, unstructured and irregular problems. Interpretive Structural Modeling (ISM) is a decision support that facilitates a comprehensive understanding of complex situations by linking and organizing ideas on a visual map so that they become a structured and related picture of issues. The objectives to be achieved from the implementation of this research is to develop and analyze a supply chain risk mitigation element at AMP in Bali Province using the guidelines for Total Quality Management.

II. Literature Review

A. Risk Mitigation

According to [4] risk mitigation planning is a process in developing actions and options to increase the likelihood and reduce threats in achieving the goals of a project. Implementation in risk mitigation is being able to carry out actions in mitigation planning. Meanwhile, the risk mitigation monitoring process includes identifying new risks and evaluating a risk process. Strategies in handling mitigation can be divided into 4 categories [5] namely:
1. Eliminating risk: namely a strategy by eliminating risk 2. Reducing risk: mitigation strategies so as to reduce the impact of risk 3. Transferring risk by means of insurance and sharing the risk 4. Accept the risk According to the mitigation strategy, it can be grouped into 4 parts, namely: 1.Assume, accept: admit the existence of a particular risk and make a decision deliberately accepting the risk without being specifically involved in controlling it 2. Control: implementing actions to minimize the impact or risk likelihood 3. Transfer: reaffirming the capabilities, responsibilities and authority of other stakeholders who are able to accept existing risks 4.Watch/monitor: monitor changes that occur in an environment Therefore, managers need to choose risks based on factors such as sources of risk, causes and resources owned by the company. To manage risks in the supply chain it is necessary to consider the types of risks and the causes of risk. Risk can be characterized based on incidence, impact and correlation [6]. Meanwhile, according to supply chain management, there are 2 types of risk management actions, namely Reactive measures and Preventive action.

Both of these actions are taken to reduce the impact of the risks that occur. Preventive instruments are mitigation related to the causes of risk associated with lowering the probability of a risk. Meanwhile, reactive instruments are oriented towards mitigating the effect of a negative event on a risk. This reactive action aims to reduce damage due to risk. Jüttner (2010) identifies mitigation in the supply chain into 4 strategies, namely avoid, control, cooperation and flexibility as shown in Table 1.

TABLE I
IDENTIFIES MITIGATION IN THE SUPPLY CHAIN INTO 4 STRATEGIES

Mitigation action	**Keterangan**
Avoid	*Dropping* *specific products/geographicalmarkets/supplierand/ or customerorganizations*
Control	*Vertical integration*
Cooperation	*Joint effort to improve C visibilty*
	Joint efforts to share risk-related information
	Joint efforts to prepare Supply Chain continuity plans
Flexibility	*Postpone*
	Multiple sourcing
	Local source material

Source : Jüttner (2010)

A These reference sources, risk mitigation can be broadly divided into reactive measures, namely risk mitigation actions that have occurred can consist of avoiding, eliminating, reducing and preventing risk mitigation planning efforts in the long term, namely efforts to prevent risks, for example according to by avoiding, cooperating, flexibility as well as risk mitigation, namely transferring and sharing risks to other capable parties

B. Implementation of Total Quality Management (TQM) in Risk Mitigation

Quality management system that focuses on Customers (Customer focused) by involving all levels of employees in making continuous improvements or improvements (continuously) to improve production process performance.[7] Total Quality Management or TQM uses strategies, data and effective communication to integrate quality discipline into company culture and activities. In short, TQM is a management approach to achieving long-term success through Customer Satisfaction.[8]

TQM is a un-management approach to obtain long-term success that focuses on customer satisfaction (customer satisfaction). An organization that works based on TQM is based on improving the quality at all stages of production to improve the quality of these production stages. TQM also helps in reducing risk to manufacturing companies, improving customer experience and ensuring every employee is working properly and is up-to-date on training. The steps for implementing TQM in an organization are as follows:

1.Customer Focus Every customer expects a good level of quality. Companies can invest their efforts through several methods such as upgrading software and computers, training employees, buying new equipment, integrating quality through state-of-the-art design processes. This will increase the overall quality of production which will be able to produce products that increase customer satisfaction.

2. Total Employee Involvement
All employees in the company contribute actively in achieving company goals, The right environment and good management can increase company commitment, Operational business operations must be integrated with a good work system

3. Process Centered / Process Centered
The evaluation process can contribute to TQM. This process includes inputs from internal and external suppliers. Inputs will be turned into outputs and accepted by the customer.

4. Strategic and Systematic Approach The implementation of a strategic and systematic approach will help to obtain an appropriate approach in achieving the company's goals, vision and mission. Formulation of a strategic plan that focuses on quality and strategic management.

5. Continuous Improvement
Continuous process improvement can make a company find creative and analytical steps in dealing with stakeholder expectations.

6. Decision making based on facts / fact-Based Decision Making. Data on organizational performance measurement should be collected on a regular basis. Consistent analysis of this data will increase the accuracy of future decision makers based on existing historical data.

7. Effective communication
Communication can increase motivation and maintain good morale in the company. This communication is part of daily routine activities.

The TQM approach is in line with the risk management approach which has the same goal, namely to increase the efficiency and success of the company from the description above, the application of Total Quality Management in risk mitigation has the same objectives in risk management (mitigation), namely leading to customer satisfaction and management of improving product quality and production, so that the TQM approach can be used as a reference in managing risk.

III. METHODS

In this study, there is a data collection method / technique used which is divided into 2 stages. The first stage of data collection to determine risk and measure risk used a questionnaire technique or a questionnaire combined with the interview method and the Delph method.

The second stage is data collection regarding ISM mitigation and assessment through Focus Group Discussions which will be held after the first stage is completed, the selection of FGD members is carried out by people who have expertise and competence in their fields consisting of: Contractors, Consultants, project owners, academics and competent people in AMP management. The instrument used is a list of questions given to respondents who will later respond according to the requests on the list of questions. The questionnaire will be distributed to respondents who will be used as samples in this study. The second stage with the Delphi Method, namely the experts answer the questionnaire in two or more rounds. In Data Analysis Plan, Steps to Identify Elements of Risk Mitigation such as :

1. Determination of major risk using the VAR method; unacceptable risk and undesireable risk
2. Determination of mitigation using the FGD method
3. Determination of Sub elements
4. Grouping sub-elements based on the closeness and similarity between mitigation variables and the authorities that have the task of mitigating them.
5.Naming elements based on TQM

IV.RESULT AND DISCUSSION

A.Risk Mitigation Identitication

Risk mitigation identification carried out in this study is the mitigation of risks classified as major risks. Mitigation measures and FGD. The analysis of the results of the interviews and FGDs was carried out by observing each similarity in the results of the experts' mitigation answers to each major risk. After the risk mitigation is identified, then proceed with grouping the mitigation. This grouping is based on the similarity of procedures and mitigation measures. This grouping is due to the large number of risk mitigations, so that these mitigations are grouped based on similarities and similarities of efforts. Each mitigation variable is adjusted and grouped into main elements. This main element is based on the company's programs and objectives in achieving quality and company performance adopted from TQM. Mitigation identification can be seen in Table 2.

TABLE II
MITIGASI RISIKO UNACCEPTABLE

No	Risk	Mitigation step
1	Material prices less competitive	Adding and exploring new sources of similar material to reduce production costs by quality records are met
2	Unhealthy competition from competitors	1. Strict regulation on related issues 2. Increase production efficiency by revamping the system

3	Economic issues; both external and internal	1. Improving management efficiency 2. Production efficiency
4	Low Project bid prices	1. Regulations governing the determination of auction winners
5	Management that works is not according to procedures	1. Improvement of the communication system 2. Establish communication to various parties in a pro active
6	Lack of HR training time	1. Provided continuous training time 2. Allocation of funds for training 3. Actively following the development of training information 4. Selection of experienced workers
7	Weather-related production delays	1. Schedule well 2. Update with weather forecast prediction 3. Production process innovation
8	Environment and Society	.1.Commitment to protecting the environment 2. Active coordination and communication with related communities 3. Innovation in material transportation process and production process
9	Warehouse Inadequate storage of raw materials	1. Choose a place feasible so that the material is not contaminated by dust and rain hujan 2. Make hangars for storage of raw materials the
10	The sudden increase in material prices	.1.Sufficient stock for production must be met before the production schedule 2. Sufficient stock for production must be met before the production schedule 3. Availability of sufficient initial capital 4. Adequate warehouse storage
11	The price increase of asphalt	1. Sufficient stock for production must be met before the production schedule
	suddenly	2. More than one source to get competitive prices 3. Availability of sufficient initial capital 4. Adequate asphalt storage tank
12	Lack of Field Prepara tion	1. Coordination with the field 2. Coordination with the field 3. Make a time schedule carefully 4. Labor discipline
13	Generator Set Damage, electricity during production	1. Scheduling continuous equipment maintenance and continuous equipment maintenance 2. Rescheduling of project implementation: increasing production capacity and / or extension of the project implementation time and or completion by means of a tripartite agreement 3. Provide a backup power source 4. Availability of spare parts
14	Raw material testing and manufacture of JMF Production delays	Production delays
15	Lack of asphalt mix transportation fleet Lack of asphalt mix transportation fleet	1. Late delivery of the asphalt mixture to the field. 2. Interfering with the project completion schedule. 3.Idle asphalt mix production equipmen
16	Late delivery of the asphalt mixture to the field. 2. Interfering with the project completion schedule. 3.Idle asphalt mix production equipment	Decline in product quality and risk of work accidents.
17	Lack of supply of raw materials / hotmix materi	Production delays, disrupting the project completion schedule
18	Environmental pollution noise, dust and smoke	Environmtal damage
19	Delay in payme due to project delays	1. Influencing the absorption of project fund allocations 2. Overhead costs

		service providers are increasing
20	Reputation risk and good name (default)	Decline government trust

Mitigation measures for undesireable risk are also obtained through interviews, expert opinions. This overall mitigation is an effort that has been carried out by practitioners in the field when facing each of these risks. Mitigation recapitulation and risk impact can be seen in Table 3.

TABEL III
RISK MITIGATON UNDESIREABLE

No	Risk	Mitigation
1	Requirements that exceed production capacity at the end of the project	1. Arrangement of the tender process (project start) 2. Taking projects according to ability 2. Scheduling and production arrangements 3. Discipline of schedule implementation
2	Delay in Delivery due to disaster	1.Production arrangement 2.Rescheduling completion of work 3. Make changes to the contrac
3	Risk of lack of experience in production human resources	1. Commitment to human resources for production management 2. 2. Recruitment of the right HR 3. 3. HR training
4	The risk of crusher and AMP in separate locations	1. Choose the location closest to the source of raw materials
5	Material quality risk: not according to technical specifications	1. Written commitment from the contractor to the tender document (General / Special Spec and BOQ and DED drawings
6	The poor material condition comes from one source	Adding and exploring new sources of similar material to reduce production costs provided that quality records are met
7	Risk of Unavailability of materials quality	Idem 4
8	Risiko ketidaksiapan SD produksi	Risk of unpreparedness of production SD
9	RK3L risk	1. Assertiveness and discipline of HR 2. Production scheduling
10	Risk of damage to the stone crusher	1.Machine maintenance regularly and periodically 2.Manage / selection of HR 3. Have spare spare parts 4. Providing unexpected / overhault funds
11	Risk of damage to the stone crusher	1.Machine maintenance regularly and periodically 2.Manage / selection of HR 3. Have spare spare parts 4. Providing unexpected / overhault funds
12	Risk of spare parts availability and less maintenance	1. Have spare spare parts 2. Schedule maintenance that is done regularly 3. Adequate human resources
13	Filter tool malfunction	Filter tool malfunction
14	Faulty filter in the hotbin	1. Have backup tools 2. Repair immediately 3. Schedule maintenance regular
15	Coordination risks between units	1. Commitment and motivation of the human resources involved 2. Planning activities properly 3. Implementation of a structured work system
16	The risk of delays in the transportation fleet	1. Fleet preparation 2. adequate transportation 3. Good fleet scheduling 4. Good coordination with the transport section
17	Project downtime risk	1. Repair and maintenance of equipment 2. Procurement of materials for production purposes 3. Human resource development

The next step of the analysis is to classify the mitigation according to the company's programs which are grouped into element classification. All Unacceptable Risk mitigation and Undesireable Risk are grouped under company program elements.

.TABLE IV
PROGRAM PLANNING

No	Elements	TQM Pillars
1.	Contractor commitment	Leadership, commitment
2.	Leadership	Leadership
3.	Organizational development	Commitment, Organization, Leadership
4.	Continous Innovation	Commitment, Organization, Leadership Commitment, Organization, Leadership ,
5	Continous Improvement	Production process, organization commitment
6	Effective Communication	Production process, organization commitment, leadership
7	Comprehensive maintenance program	Production process, organization commitment, leadership
8	Optimal material preparation	Production process, organization commitment, leadership
9	Reliable Transportation	Production process, organization commitment, leadership, communication
10	Consistency K3 consistency	Production process and commitment
11	Environment and cultural preservation	Leadership, organization, commitment

Program planning is an important program in an effort to mitigate risk. And for analysis purposes it is summarized into 11 elements. These eleven elements are then divided into several mitigation sub-elements as a result of this FGD. Elements of the company's mitigation program are obtained by naming the mitigation elements obtained through FGD based on the TQM total quality management program). The grouping of mitigation elements is elaborated with TQM elements, TQM pillars and TQM characteristics, namely: The five pillars of TQM are: 1.Product: a product produced by production 2. The process of production activities 3. Organizations that are responsible for handling risk mitigation activities 4. Leaders who are responsible for the process and results of activities 5. Commitment from company members to TQM Identification of Element Categories can be seen in Table 4Table 4 Element Categories.

V. CONCLUTIONS

All Unacceptable Risk mitigation and Undesireable Risk are grouped under company program elements. Program planning is an important program in an effort to mitigate risk. And for analysis purposes it is summarized into 11 elements. These eleven elements are then divided into several mitigation sub-elements as a result of this FGD. The next step of these research can contotue to find out the contextual relationship to be observed, by developed SSIM matrix using the symbols V, A, X, O and the SSIM was obtained for each element.Then we obtained the Reachability Matrices for each element of each SSIM by replacing the values V, A, X, O with the number 1 or 0. The contextual relationship produce the elements that drive the system and influence mitigation the most.

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