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Managing Risk of Lean Manufacturing Concept Implementation Approaching by Delphi and HOR

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Abstract-The implementation of Lean Manufacturing (LM) concept was first performed at automotive industries. It is not easy being lean. Lean manufacturing concept implementation will not succeed at the first time. There were things that may have prevented the implementation meeting the objective is considered as risk. It necessary to maintain the risk of LM concept. This research will show the way for managing risk of LM implementation by Delphi and House of Risk method. This research was team up with aerospace industry in Indonesia who has been implementing LM concept. In this research, 19 risks have been identified. The rank of risk agent has been determined.

Index Terms - Risk, lean manufacturing implementation, delphi, house of risk.

INTRODUCTION

The implementation of Lean Manufacturing (LM) concept was first performed at automotive industries such as Toyota. The LM concept was able to adapted in many areas or industries including aerospace industry [1]. Because of LM concept has succeed implement at automotive industries, but there were many assumptions take into account when the LM concept has been implementing in another areas or industries especially aerospace industry.

It is not easy being lean [2]. LM concept implementation will not succeed at the first time. There were many fail to be learned when the company implement LM concept in its very first time such as lack of management commitment, lack of autonomy's team, no transparancy from management to socialize the objective's LM implementation, no mechanism for LM implementation, lack of communication, no evaluation and improvement plan be sustain [2].

The lean manufacturing concept implementation in this aerospace industry is done through projects or programs which have not yet meet the objectives. The thing that may have prevented the program meeting the objective has considered as risk. It necessary to prevent the potential risk occur. The main purpose of this research

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is how managing the risk of LM concept implementation with several methods.

DEVELOPMENT OF RISK MANAGEMENT

Risk can be defined as a disadvantage or loss of project's profit [3]. It necessary to maintain the potential risk. There was risk management which is concern to maintain the potential risk. Risk Management framework based on ISO 31000:2009 provides the generic model. In that general model consists of several phases such as context determination, risk assessment, risk mitigation, communication and consultation, also monitoring and review [4].

Several risks can be occured when LM concept was implementing such as people demotivated after a few years implementing LM concept, lack of LM knowledge, lack of communication, etc [5]. Those of risk of LM concept implementing had been identified by collecting some literature study.

There were many methods can be used to identify the potential risk. Risk identification can be figured out by depth interview, brainstorming, questionnaire, historical document, judgment based on experience, and direct observation. Then, it necessary to identify the risks analytically by expert. Delphi method is utilized to gather the potential risk from expert. Delphi method is a way of obtaining a collective view from individuals about issues where there is no or little definite evidence and where opinion is important. It is an iterative questionnaire exercise with controlled feedback to a group of panellist who are anynomous [6].

Risk identification also need to define whether risk agent or risk event. There is one method namely by House of Risk (HOR) which is combined from two model both failure mode and effect analysis (FMEA) and house of quality (HOQ) [7]. HOR is divided into two model, HOR 1 and HOR 2. HOR 1 has functioned to rank the risk agent based on their aggregate risk potential (ARP). ARP was calculated with formula below.

$$ARP_j = O_j \sum_i S_i R_{ij} \quad (1)$$

HOR 2 has funtioned to prioritize the proactive actions that the company should pursue to maximize the cost-effectiveness of the effort in dealing with the selected

risk agents in HOR 1. In this research, only use HOR 1 in order to know the prioritize of risk agent.

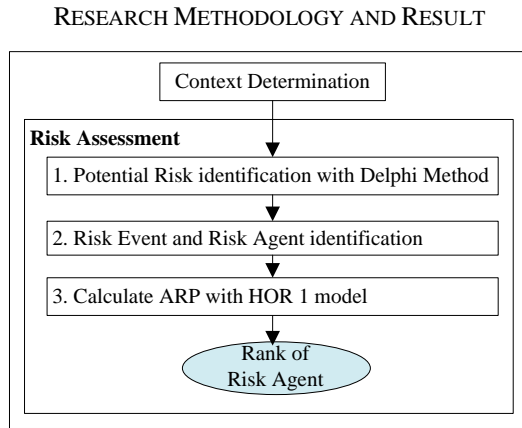RESEARCH METHODOLOGY AND RESULT

Figure 1. Research Methodology.

I. Context Determination

This phase will determine the scope of doing this research. The object of this research is in an Indonesian aerospace industry who has implemented LM for several years. The company was implementing LM concept as pilot project in several division.

II. Risk Assessment

This phase will conducted by risk identification, risk analysis, and risk evaluation. Risk identification has figured out with Delphi method. The Delphi method consists of several steps. First, determine the team who monitor and responsible the Delphi process, in this research that is not only manager Lean & Development Department but also the researcher. Second, select responden that is consists of manager and head of division in Production Directorate. Third, explain the objective of Delphi process that is to identify potential risk of LM implementation. Fourth, establish questionnaire each round. Fifth, establish resume result each round. In this research conduct by three rounds and there had been consensus. Table 1 shows partial list of 19 risks have been identified and classified whether risk events or risk agents. There were 10 risk events and 9 risk agents.

TABLE 1. PARTIAL LIST OF RISK LEAN IMPLEMENTATION.

Code	Risk Events	Code	Risk Agents
E1	action plan couldn't be finished on time	A1	lack of consistent and commitment top management
E2	demotivated employee	A2	lack of supporting facilities
E3	employee did not feel responsible with lean	A3	lack of lean manufacturing implementation knowledge
...	...	...	...
E10	lean training material was not delivered well	A9	difficult to change work culture

ARP was calculated by equation 1. O_j is the probability of occurrence of risk agent j, S_i is the severity of impact if risk event occured, and R_{ij} is the correlation

between risk agent j and risk event i that is scale 0, 1, 3, 9 refers to no, low, medium, and high correlation.

In this research, the top rank of risk agent has to be prioritized is code A4 refers to lack of communication and socialize from management to employee with ARP value 824. Then, code A3 refers to lack of lean manufacturing implementation knowledge and tools with value 604 and code A5 refers to lack of human resources qualification with value 556.

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