

Measurement of Cost & Benefit for Implementation of Risk Management in the Production Process

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Abstract—*The paper aims to measure the overhead costs and economic benefits of risk management activities in the production process - a manufacturing company. This research uses Activity Based Management (ABM) approach to allocate and track overhead costs in risk management activities. The overhead costs of risk management activities include the costs of identifying, analyzing, evaluating and controlling risks in order to achieve the quality objectives of the production process. The company obtains economic benefits, first, from reducing overhead costs incurred per period from the results of improvements to non-value-added or high-cost activities; second, cost savings obtained from the achievement of quality objectives per period. The results of this study indicate that the ABM approach used is appropriate in measuring the overhead costs and economic benefits of risk management activities in a business process.*

Keywords—*Activity Based Management Approach, risk Management, Cost and Benefits.*

I. INTRODUCTION

Risk management is a strategic management tool encourages decision makers to imagine the future conditions of the organization by exploiting opportunities and avoiding potential threats [1]. Risk management is an activity of identifying, assessing, monitoring and controlling risks intensively in various events that occur within the organisation [2]. The definition of risk according to international standards ISO 31000 is the effect of uncertainty in achieving organisational goals. So that efforts to reduce risk are efforts to overcome failures in achieving organisational goals [3].

Risk management is part of organisational governance in determining strategies, decision making for risk control in achieving the organisational objectives. Risk management is all organisational activities related to stakeholders, and part of discussing external and internal issues of the organisation [4]. According to ISO 31000, risks related to internal and external issues of the organisation can include risks to quality, environment, safety, financial performance and others [5].

A number of studies in the risk management area discuss about the impact of implementing risk management on achieving organisational operational performance, but rarely discuss the impact on financial performance. Several of research that address the impact of implementing risk management on organisational operational performance such as the use of FMEA method for health and safety risk analysis for nurses and doctors [6], use of risk management to improve the competitiveness of companies [7], and use of risk assessment on software development to reduce potential security weaknesses in software [8]. Meanwhile, research that discusses the impact of implementing risk management on the financial performance of organizations such as the use of risk management tools to measure profits at the farmer level [9]. Unfortunately, those research used the empirical data, and did not use the company's operational data. Therefore, the results of the study cannot be traced in more detail to how the implementation of risk management has an impact on the company's financial performance.

This paper discusses the impact of implementing risk management on the achievement of operational performance, where the impact is associated with economic benefits such as savings in costs obtained. To achieve the research objectives, researchers used the Activity Based Management (ABM) approach to measure the cost allocation spent with cost savings obtained through case studies of the application of risk management in a manufacturing business process.

II. LITERATUR REVIEW

As a management framework, the successful implementation of risk management is influenced by role of the organization's leader. The researchers show the success of the leader's role in the creation of product creativity and innovation by always considering management control in anticipating the risk of failure [10]. The role of the leader is also needed when organizations design a risk management framework to anticipate changes in the corporate environment such as changes related to the industrial revolution 4.0 [11], and the role in determining Key Performance Indicators (KPI) and Key Risk Indicators (KRI) [12].

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A number of risk management studies are related to the achievement of company performance such as research on the application of risk management that aims to mitigate oil spill cases that are at risk to operators and environmental pollution [2]. Research on implementing ISO 31000 risk management standards to improve the success of an engineering project [13]. Risk management can also reduce the impact of uncertainty about prices and costs of electricity production [14]. Risk management as a decision support tool to reduce the potential risk of cargo ship accidents on the coast and sea [15].

From a number of these studies it can be said that the application of risk management successfully helps the organization in achieving its objectives through activities carried out such as identification, analysis, assessment, and risk control. Unfortunately, some of these studies do not discuss the costs for implementation of the risk management activities. In addition, research that discusses the economic benefits of implementing risk management in companies including in a business process is also still rare. Therefore, it is important to conduct research related to cost and economic benefits for implementation of risk management in the company's business processes.

Risk management activities require costs, which are often referred to as overhead costs. Overhead costs are costs beyond direct and material labor costs [16]. These overhead costs can include costs for preparing risk management documents (e.g. making standard operating procedures, risk registers, tables for identification, analysis, assessment and risk control), discussing strategies for achieving performance targets, monitoring and evaluating risk controls.

One approach to measuring overhead costs is to use the Activity Based Costing (ABC) approach. For research in the area of Total Quality Management (TQM), the extension of the ABC approach is called the Activity Based Management (ABM) approach [17]. The ABM approach is based on obtaining cost information on value-added and non-value-added activities in a business process. In addition, the approach also aims to achieve performance targets from processes, products, or services [18]. Thus, the ABM approach is an effective and efficient management system for managing a business process or activity [19].

III. METHODOLOGY

The ABM approach is used to measure the allocation of overhead costs for risk management activities and tracking them to the source of costs incurred. Tracking overhead costs to source costs is to identify inefficient use of resources and as a opportunities to take corrective actions. For example, the quality performance of the production process is important to ensure product conformity to customer requirements. If the customer is not satisfied, then they reject the product and return it to the company.

Product returns have an impact on the risk of high costs for reworking or replacing new products.

This research method integrates the stages in the ABM approach and the risk management process into the research steps (Figure 1.). The steps of the ABM approach include the cost assignment view and process view, Pareto analysis, identification of root causes of the problem, and corrective action. While steps of the risk management process consists of risk identification, risk analysis and evaluation, and risk control. Furthermore, the research steps include data collection, analysis, reports of cost expenses and cost savings.

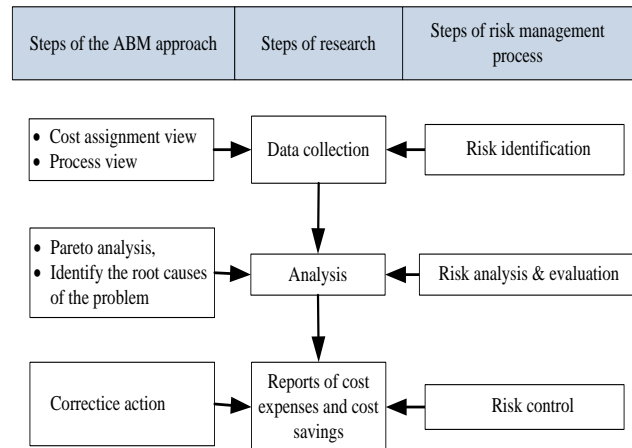


Figure 1. Integration of the ABM approach, risk management process, and research steps

A. Steps of Research

Data collection. From the observation, it is known that the company produces 120 pairs of shoes per day. Employee working hours are 25 working days per month and eight hours per day. While the employee wages are IDR 20 thousand per hour. The performance target in the production process is the maximum percentage of defective products is 10%. Meanwhile, the production cost for a pair of shoes is IDR 285 thousand.

The researcher collects overhead costs information for risk management activities in the shoe company's production process through the cost assignment view and process view of the ABM approach [20]. Risk management activities include identifying, analyzing, evaluating and controlling sources of risk that have the potential fail to achieve performance targets in the production process.

Cost assignment view aims to allocate resources to cost objects, through two phases, namely: selecting activity drivers (e.g. man hours/batch) to determine the type of resource (e.g. human), and allocating cost objects using driver activity. Table 1 describes cost objects, name and drivers of activities, resources and drivers of resources for implementing risk management.

TABLE 1. THE COST ASSIGNMENT VIEW APPROACH FOR IMPLEMENTATION OF RISK MANAGEMENT IN THE PRODUCTION PROCESS

Cost objects	Name of activities	Activities Driver	Resources	Resource Drivers
Overhead costs for implementation of risk management activities in the production process	A= Preparation and control of documents related to risk management, such as SOP documents, risk registers, tables of identification, analysis, assessment and risk control	Man hour/batch	Man	Man hour
	B= Discuss issues of the company to develop work programs and set performance targets	Man hour/batch	Man	Man hour
	C= Discussion of risk control measures to achieve performance targets	Man hour/batch	Man	Man hour
	D= Implementation of risk management	Man hour/batch	Man	Man hour
	E = Monitoring, measuring, analyzing and evaluating risk management	Man hour/batch	Man	Man hour
	F= Management review to discuss the effectiveness of risk management	Man hour/batch	Man	Man hour
	G= Continuous improvement of risk management	Man hour/batch	Man	Man hour

Process view includes determination of cost drivers, name of activities, Value-Added (VA) or Not Value-Added Activities (NVA), and performance targets in the production process (Table 2). For high-cost activities, it is a priority for companies to take corrective actions in reducing those costs.

TABLE 2. THE PROCESS VIEW APPROACH FOR IMPLEMENTATION OF RISK MANAGEMENT IN THE PRODUCTION PROCESS

Cost Drivers	Name of activities	VA and NVA	Performance target
Implementation of risk management in the production process	A	VA	Maximum percentage of the defective products is 10%
	B	VA	
	C	VA	
	D	VA	
	E	NVA	
	F	VA	
	G	VA	

Analysis. Pareto diagrams are used to determine high-cost activities of the risk management implementation [21]. For high-cost activities, companies shall identify and analysis root cause of the problems, and take corrective action such as designing methods that are more effective and efficient. Furthermore, the company shall also analysis and evaluate the achievement of performance targets and obtain cost savings.

Reports for expenses and cost savings. The company takes corrective actions for high-cost activities and the achievement of performance targets as a risk control. If the corrective action is effective, then in the subsequent period, the company should obtain cost savings that came from the reduction of high-cost activities and the achievement of performance targets. However, the company incurs costs to implement corrective actions related to controlling the risk.

The preparation of the report consists of reports on overhead costs, and cost savings for implementation of the risk management.

IV. CONCEPTUAL MODEL

The conceptual model of measuring overhead costs and economic benefits for applying risk management in the production process for t periods is shown in Figure 3.

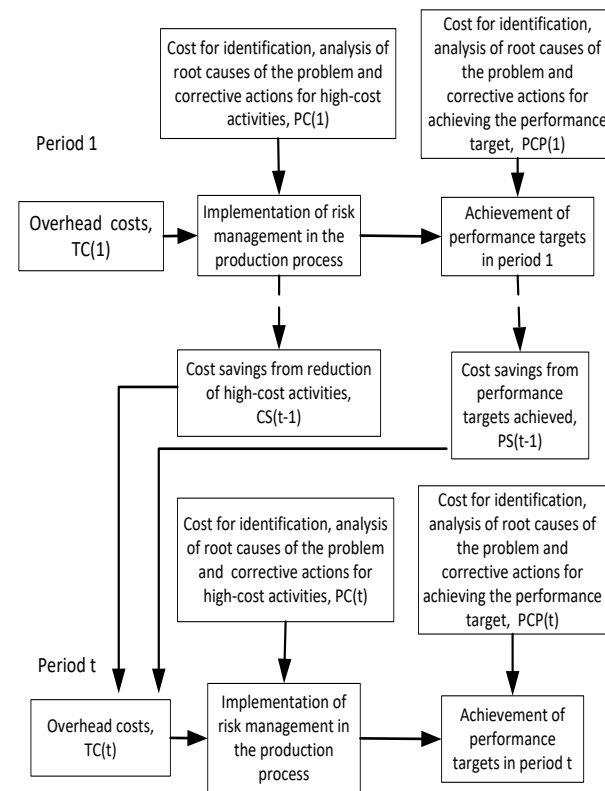


Figure 2. The conceptual model of measuring overhead costs and economic benefits for implementing risk management in the production process for t periods

In period t (t = 1.2 ..., t), the company spends overhead costs of TC(t) for implementation of the risk management. In the context of cost efficiency, the company analyzes high-cost activities using the Pareto diagram, identify root causes, and take corrective action. For these activities, the company spends overhead costs of PC(t). In addition, the company also identifies the root causes of the problem to increase the achievement of the performance targets and the company spends overhead costs of PCP(t). As a result of effective corrective action, the company obtains cost

savings of CS(t) for reducing the high-cost activities, and cost savings of PS(t) for achieving the performance targets. From the conceptual model, then a mathematical equations are derived as follows,

$$TQC(t) = TC(t) + PC(t) + PCP(t) \quad (1)$$

$$S(t) = CS(t) + PS(t) \quad (2)$$

$$TC(t + 1) = TQC(t) - S(t) \quad (3)$$

where is,

TC(t) = Overhead cost for risk management activities in period t,

PC(t) = Overhead costs for analysis, identification of root causes, and corrective actions for high-cost activities in period t,

PCP(t) = Overhead costs for analysis, identification of root causes, and corrective actions to increase performance targets in period t,

CS(t) = Cost savings obtained from reducing of high-cost activities in period t,

PS(t) = Cost savings obtained from the results of achieving performance targets in period t,

S(t) = Total cost savings obtained in period t,

TQC(t) = Total overhead costs in period t.

V. RESULTS AND DISCUSSION

Table 3 illustrates overhead for implementation of the risk management in the production process for period 1. The activities use human resources with working hours as a resource driver. If overhead costs for employee is IDR 20 thousand per hour, then the total overhead cost of the risk management activities for 1st period is IDR 3.680 million.

TABLE 3.
OVERHEAD COSTS OF RISK MANAGEMENT ACTIVITIES IN THE PRODUCTION PROCESS FOR 1ST PERIOD

Name of activities	Number of employee working per month	Overhead costs, (in thousands of rupiah)
A	24	480
B	18	360
C	18	360
D	72	1440
E	24	480
F	4	80
G	24	480

Furthermore, the company identified and analyzed high-cost activities using the Pareto diagram (Figure 3). The results of identification and analysis found that each high-cost activity is as follows: the application of risk management (activity of D); preparation and control of documents related to risk management, such as SOP documents, risk registers, tables of identification, analysis, assessment and risk control (activity of A); monitor, measure, analyze and evaluate risk management (activity

of E); continuous improvement of risk management (activity of G). During period 1, in order to increase the effectiveness and efficiency of the implementation of risk management, the company decided to develop a software application to support the implementation of risk management at a cost of IDR 1.2 million. With this application, the company obtained savings in efficient time through the use of the application. When the savings in efficient time measured in value for money, then the company obtained the cost savings of IDR 1.320 million.

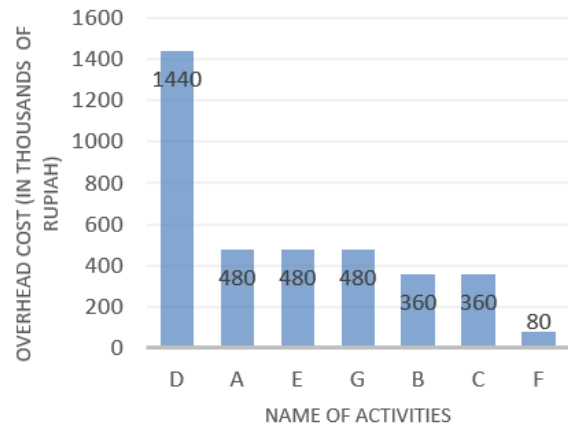


Figure 3. Pareto diagram of overhead costs for risk management activities in the production process for 1st period

Furthermore, the company controls risk to achieve performance targets in the production process, where the percentage of defective products is 10%. The type of defect that occurs is a defect in the raw material. The results of analysis root cause of the problems, then the company takes corrective action through inspection of raw materials to the supplier's workplace. For this activity, the company spends around IDR 900 thousand. As a result of this corrective action, the company obtained a cost savings of IDR 1.026 million from the reduction in the target of defective raw materials from 10% to 7%.

Thus, the total cost savings in period 1 is IDR 2.346 million from the result of reducing high-cost activities and achieving performance targets. Whereas the total overhead costs of identifying, analyzing and corrective actions for high-cost activities and achieving performance targets in period 1 is IDR 2.1 million.

Table 4 shows a summary of overhead expenses, the savings in the costs of risk management activities in the production process for the 12 periods are as follows.

In Table 4, at the end of period 4, the company obtained cost savings of IDR 1.321 million. If the cost savings is reduced by the total overhead cost at the end of period 4 of IDR 1.040 million, then at the beginning of period 5, the company has savings of IDR 281 thousand and this savings is likely to increase in subsequent periods.

TABLE 4.

OVERHEAD COST AND COST SAVINGS FOR IMPLEMENTATION OF RISK MANAGEMENT IN PRODUCTION PROCESS (IN THOUSAND RUPIAH)

t	TC(t)	PC(t)	PCP(t)	CS(t)	PS(t)	TQC(t)	S(t)
1	3680	1200	900	1320	1026	5780	2346
2	3434	400	300	1410	342	4134	1752
3	2382	200	200	1700	342	2782	2042
4	740	200	100	1150	171	1040	1321
5	(-)281	100	50	200	171	(-)131	371
6	(-)502	50	50	100	171	(-)402	271
7	(-)673	0	50	0	171	(-)623	171
8	(-)794	0	50	0	171	(-)744	171
9	(-)915	0	25	0	171	(-)890	171
10	(-)1061	0	25	0	171	(-)1036	171
11	(-)1207	0	25	0	171	(-)1182	171
12	(-)1353	0	25	0	171	(-)1328	171

*) (-) company obtains a profit

VI. CONCLUSION

The results of this study confirm the research conducted by [12] and [11] which states that the application of risk management in achieving operational performance targets can have economic benefits.

In contrast to research in the area of risk management that has been carried out by several researchers, this research is to use company operational data to measure overhead costs and cost savings in the risk management application program in a business process of a manufacturing company.

The ABM approach is a suitable approach to encourage risk management managers and staff to be directly involved in reducing high-cost risk management activities and achievement of the performance targets. Note that the cost savings obtained from achieving performance targets are influenced by the target level set. For the higher target level, then more difficult to achieve the target, which results in a smaller contribution to the cost savings. As a result, the duration of the investment return takes a long period.

The company can use the conceptual models and formulas to measure overhead costs and economic benefits. From the results of this study, it allows companies to know the distribution pattern of accumulated overhead costs and cost savings for each period, so that the company can estimate how long the return period of investment for risk management activities.

However, this study has a number of limitations, such as only considering only one performance indicator in the production process. Therefore, for the future research can consider to number of performance indicators more than one in each business process.

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