Risk-based sustainability balanced scorecard to prioritize integrated improvement and to consider high level structure

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Abstract. Today, countries pay attention to the issue of sustainable development which begins to underlie activities from various fields. This issue forces companies to concern about sustainability issues by improving the process to become a green process. Consequently, the performance measurement system to measure the success of the green process needs to be developed. One of the examples is Sustainability Balanced Scorecard (SBSC) which is a developed form of Balanced Scorecard. SBSC is a tool for measuring performance by considering evaluation aspects of profit, planet and people. Currently, the assessment of the success of a company, however, is completed by observing the achievements of Key Performance Indicator (KPI) only, whereas the good performance of the company is also influenced by the risks of other businesses. Therefore, risks that affect the company need to be regulated and considered so that control to the company activities can be integratively conducted. Based on this research gap, this paper aims to initiate the integration of risk management with SBSC in measuring company performance. This integration effort can affect the priority of improvement for the company. As a case study, the results of the integration were tested to measure the performance of companies that produce construction materials. Based on this integration, the obtained results show that risk-based thinking in the Performance Measurement System can provide a new approach to assess the performance of a company.

1. Introduction

The issue of sustainable development does not only affect the technical field to develop sustainable manufacturing globally but also has consequences for the way of measuring performance as in the Balanced Scorecard. Balanced Scorecard (BSC) is a management system that guides organizations to translate their vision and mission into controlled real actions [1]. By using BSC, companies can measure their financial performance, learning and growth, customer focus and internal business processes. In the influence of the issue of sustainable development, BSC is developed by adding aspects of performance measurement, i.e. the sustainability aspect that will control environmental activities and social activities. Considering the importance and development of sustainability issues for company to control the activities regarding 4 aspects and sustainability aspect makes BSC converting into SBSC. In implementation, SBSC is developed by directly adding sustainability aspect into the old BSC's aspects so it has financial, learning and growth, customer focus, internal business and sustainability as perspectives. The other method to develop BSC is inserting sustainability aspects into each perspective of financial, learning and growth, customer focus, internal business. Basically, the fundamental difference between BSC and SBSC is on the sustainability aspect. Hence, the company can control its activities as a whole so that all companies can guarantee that their entire activities are in accordance with the established business strategies. The success of a company's business strategy,

however, is not only influenced by performance achievements that are relevant to a particular strategy but also influenced by the risks that affect the course of the company. It relates to the evaluation and the forecasting of future undertakings, processes and activities which are accompanied by uncertainty and risk [2]. Performance achievement itself is also influenced by the risks that affect it [3]. This risk awareness also lies behind the improvement of ISO that is developed by paying attention to the concept of risk-based thinking. With the concept of risk-based thinking, the design and implementation of ISO can be carried out integratively among ISO standards. By considering the effect of risks, companies can reduce uncertainty in achieving objectives, taking preventive actions, and complementing quality management principles, especially the principles of the process approach [4]. The rationale can be applied to the performance measurement system. By taking the effects of risks into account, the company can reduce the uncertainty in achieving the target of each Key Performance Indicator (KPI) and take preventive actions against the inability of achieving the targets for each KPI with the principles of process approach. Thus, companies consider the high level structure in controlling their business. The integration of risk based thinking in performance measurement can contribute to the determination of the priority of improvement. Some of the obtainable benefits from the integration of risk based thinking with SBSC, performance measurement system, are developing or improving the company activity management that is more comprehensive and integrated, familiarizing proactive culture in achieving KPI targets as a form of risk awareness, and assisting to match the targets and the execution ways so that the affecting risks can be managed properly.

2. Methodology

The methodology used in this paper is the development of general performance measurement framework. The development is viewed in the integration of risk-based thinking so that the framework for performing the risk management will appear in the framework as a whole. For more details, the framework used in this paper is shown in Figure 1.

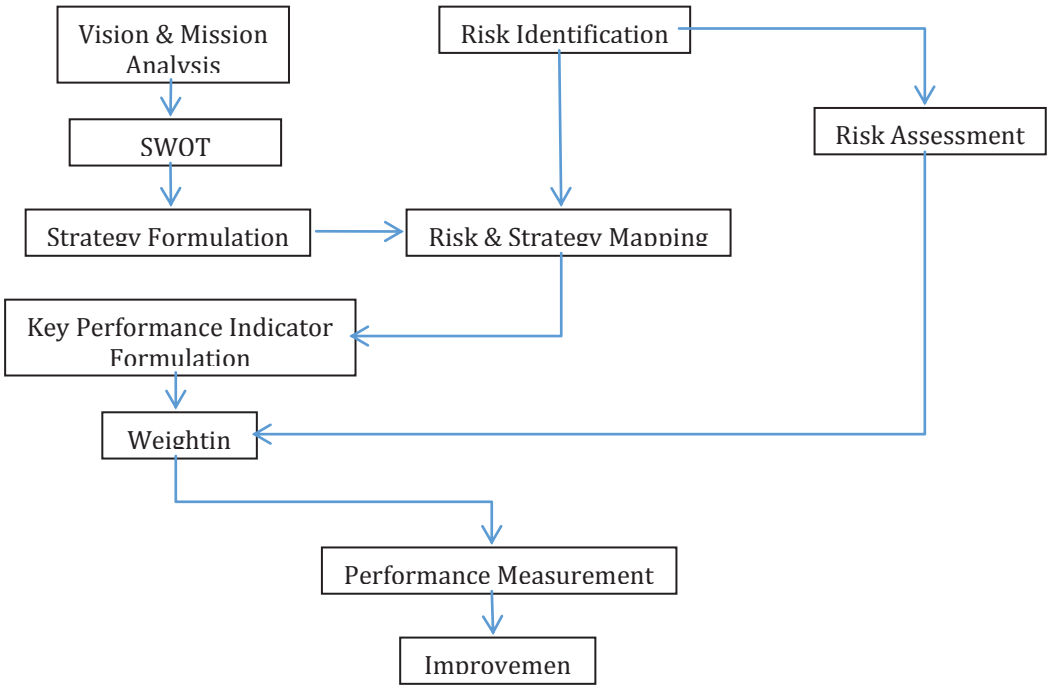

Figure 1. Framework of research

3. Literature Review

3.1 Performance Measurement System

Performance measurement is a process of quantifying the success of a company in achieving its predetermined targets. Performance measurement can also be employed to assess human behaviour in carrying out their roles in the company. In the implementation, performance measurement should include several related aspects such as aspects of cost, quality, time and flexibility [5]. In its development, several performance measurement tools define these aspects of performance. Performance prism, for example, is a tool for measuring performance that defines aspects of performance based on the interests and contributions of stakeholders [6]. Malcolm Baldrige defines 7 aspects of performance that are crucial in assessing the performance of a company [7]. Balanced Scorecard is a tool for measuring performance from 4 aspects, i.e. financial, learning and growth, customer focus, and internal business process [8]. Meanwhile, Sustainability Balanced Scorecard is the development of Balanced Scorecard to measure the implementation of sustainable strategies in an organization. Sustainability means paying attention to environmental and social elements besides economy in every business consideration that is carried out. In SBSC, a new aspect of performance is introduced as nonmarket aspect [8]. Non-market aspect is used to integrate relevant environmental and social strategic aspects. In addition, non-market aspect is often referred to as sustainability aspect. The addition of this aspect shows that the issue of sustainable development has affected the field of performance measurement. In accordance with the pillars of sustainable development, performance measurement must also be carried out equally on the triple bottom line of the company, which includes profit, people and planet. The inequality in those three pillars will cause the non realization of sustainability. With this perspective, it is expected that top management will bring the company to pay more attention to the environment and human welfare.

Moreover, in SBSC, it can be explained that financial perspective is used to measure financial performance such as income growth, cost reduction, return on capital employed (ROCE), and so on. Customer perspective focuses on customer satisfaction, customer loyalty, new customer acquisition, customer value and profitability, market share and so on. Internal business process perspective includes the discussion on the way to identify and arrange processes efficiently and effectively. Growth and learning perspectives discuss the capabilities of workers, internal abilities, skills, training, and harmony. Sustainability perspective includes the discussion on produced emissions, waste reduction, environmental preservation and energy consumption.

3.2 Risk Management

Risks describe the magnitude of the possibility of danger that can cause interference and the magnitude of severity that it causes. There are many benefits obtained when an organization decides to carry out risk management, such as increasing the awareness of all members of the organization about risks, focusing the efforts on very impactful things, instilling preventive culture and risk management, and making the organization more successful due to minimum errors. In order to manage risks, there are steps that can be taken, which are 1) Identifying risks aimed at recognizing the possibilities of risks occurring in the organization, 2) Analyzing risks aimed at determining the value of a risk by taking the possibility of occurrence and the magnitude of the consequences of these risks into account, 3) Evaluating risks aimed at classifying the level of risks using the Failure Mode & Effect Analysis (FMEA) method that serves to sort potential risks that can occur so that the organization is expected to determine the risks that must be corrected, 4) Determining risk management efforts that aim to reduce the value of a risk after determining the priority, and 5) Performing risk monitoring which serves as a risk control tool and continuous improvement efforts.

4. Data Processing and Result

Based on the methodology presented previously, the integration between risk based thinking and SBSC is applied to measure the performance of a company that produces construction materials such as light bricks and cement. Next, the company in the case study is named PT. XYZ for the confidentiality of the company. In running its business, PT. XYZ still continues to excel in its business

competition and is always committed to keep providing short-term and long-term benefits to its users, as well as providing environmentally friendly construction materials. Therefore, the manufacturing process that is in accordance with the principle of sustainable development must be measured using a performance measurement system that is also in accordance with the principles of sustainable development. Broadly speaking, the vision of PT. XYZ is to be a producer of construction materials that can be accepted by the world market by considering quality and sustainability. Based on the SWOT analysis, there are seven strategies. In addition to paying attention to the implementation of the strategies, PT. XYZ also possesses the awareness of risk. Based on the business strategies, KPI is structured as a control tool for certain business strategy implementation. Then, the company sets its targets and assessment standards or scorecards for each KPI. In measuring the performance, the score will be multiplied by the weight of KPI to determine the performance of the company. So far, KPI weighting has only been done without taking the risk factors that affect the strategies into account. In this paper, it is initiated to carry out the weighting by involving the size of risks that have been assessed. Therefore, in addition to using the pair wise comparison method, KPI weight is also multiplied by normalized RPN. The following are the results of mapping between identified risks and business strategies along with the risk assessment using Failure Mode and Effect Analysis (FMEA) for first semester of 2017 (January-June):

Table 1. Strategies & Assessed Risks Mapping and KPI Formulation

No.	**Strategy**	**Risk**	**Severity**	**Occurrence**	**Detection**	**RPN**	*Key Performance Indicator (Final Weight; Score)*				
							Financial	*Customer*	*Sustainability*	*Learning and Growth*	*Internal Business Process*
1	Expanding market share throughout the world	Quality management system does not work well	3	4	2	24	Return on Equity (0,167; 4), Net Profit Margin (0,105; 5)				
2	Improving the effectiveness of quality management system	KPI targetsare not reached	3	3	2	18		*Customer complaint (0,218; 4)*			*Defect (0,023; 5)*
3	Reducing the level of machine damage/*breakdown* and performing routine machine*maintenance*	Maintenance is not carried out according to schedule	3	3	2	18					*breakdown (0,009; 4), achieved quality target (0,009; 3)*
4	Improving the competence of company employees	KPI targetsare not reached	3	3	3	27				Number of employee training (0,062; 5), turnover (0,029; 4)	Productivit y level (0,009; 5)

No.	Strategy	Risk	Severity	Occurrence	Detection	RPN	*Key Performance Indicator (Final Weight; Score)*				
							Financial	*Customer*	*Sustainability*	*Learning and Growth*	*Internal Business Process*
5	Improving good relationships with *suppliers* and logistics companies	Material, information and financial flows are not smooth	4	2	2	16					*Supplier On Time Delivery (0,014; 3), defective raw material (0,014; 4)*
6	Increasing production capacity by paying attention to environmental and social aspects	Increasing waste	3	2	2	12			*Waste (0,076; 1), Amount of electricity kWh (0,026; 1), Number of employee program (0,011; 1)*		
7	Taking part in providing open job vacancies	Availability of decent workforce is not suitablewith needs	2	2	5	20			Local community workers (0,007; 5)		

The data above was taken based on measuring and interviewing the representative of management. It includes for assessing the severity, occurance and detection for the risks. The value of severity shows the consequence of risk happened, the value of occurrence shows the probability of risk happened, and the value of detection shows the easiness to recognize the risk before it happens. To assess the risk, we can calculate the RPN (Risk Priority Number) value by multiplying those the three values. The higher RPN is, the more important risk is. Based on the results of performance measurements, priority improvements in sequential perspective are Sustainability, Internal Business Process, Learning and Growth, Customer, and Financial. By integrating the risk and performance, those priority improvements have already covered the value of risk which is considered in high level structure and covered the achievement of each KPI. However, we still need other emprical study to explore the benefit of the integration between risk management and performance measurement system.

5. Discussion

Basically, risk is divided into two, i.e. strategic and operational risks. Both of these risks will certainly affect the company, not only in the aspects of quality, environment, and safety but also in other operational or strategic activities of the company. It will be useless if the company only pays its attention to the achievement of the success indicators in every activity without considering those risks. Awareness of the importance of risk management also becomes the background of the change for ISO, version of 2015, where the application of ISO requires organizations to identify and mitigate risks. Since risk management is integrated and pervasive, the ISO, version of 2015, is also integrated between management systems which are commonly known as High Level Structure.

Based on background of the change in ISO, there is a thought that risks affect company activities both at the strategic level and at the operational level. Therefore, in the monitoring of company

activities that are also commonly carried out through performance measurement needs to integrate risk based thinking into performance measurement. This will affect the company in giving weight to KPI or performance perspective. By explaining the existence of risks that can affect the achievement of targets for every KPI, the company is asked explicitly to give weight to KPI and considers the value of the affecting risks as well. The integration of risk based thinking into performance measurement can change the priority of improvement from the company. For example, if a KPI has low performance but not too risky, it will lose its priority with KPIs that have higher performance but high risk. It will be different if the company does not consider risk factors because the company will pay more attention to KPIs with low performance. However, there will be a possibility that the priority results will be the same for both methods if the risk value ranking is the same as the KPI weighting ranking.

6. Conclusion

The integration of management risk with performance measurement can influence the way companies provide priority improvements because these priorities are influenced by the way the company gives weight to each of the performance perspectives. Through this integration, the company is reminded that there are risk factors in performance that need to be really taken into account. Thus, performance measurement will also be High Level Structure. So far, the weighting of KPI comes from the decision maker's preferences which can be very subjective. In that preference, there may indeed be a risk assessment which is also missed, however. In this case study, the priority of improvements in PT. XYZ was obtained from sequential perspective, which includes Sustainability, Internal Business Process, Learning and Growth, Customer, and Financial.

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Welcome Remarks,
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It is a great pleasure to welcome all of you to Bali and to the International Conference on Informatics, Technology, and Engineering 2019 (InCITE 2019) held by the Faculty of Engineering, University of Surabaya (UBAYA) in collaboration with The University of Adelaide, Australia and Sirindhorn International Institute of Technology (Thammasat University), Thailand. The first InCITE has been successfully held in Bali, Indonesia in 2017. We are very delighted to host the second InCITE here in Bali, Indonesia again.

There are more than 75 presentations in this conference. We welcome leading experts not only from Indonesia, but also from different parts of the world. The experts will share the knowledge and experiences in the fields of informatics, technology, science, and engineering. The main theme of this conference is **Enhancing Engineering Innovation Towards A Greener Future** in response to several world challenges including sustainable development, global convergence of information and communications technologies, climate change and global warming as well as the depletion of unrenewable natural resources. We hope this conference will provide you a good opportunity to get to know each other better and consolidate bonds of friendship and mutual trust.

We would like to express our sincere gratitude to the Keynote and Plenary speakers, International Scientific Committee, Steering Committee, and Organising Committee for their huge efforts to make this conference successful.

Thank you all for your support and attendance at InCITE 2019. Please enjoy the conference and Bali !

Asst. Prof. Djuwari, Ph.D.

Preface

Welcome Remarks,
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Welcome to Bali, Indonesia to all delegates and presenters. It is my pleasure and privilege to welcome all of you to the 2nd (second) International Conference on Informatics, Technology, and Engineering 2019 (InCITE 2019) held by the Faculty of Engineering, University of Surabaya (UBAYA) in collaboration with The University of Adelaide, Australia and Sirindhorn International Institute of Technology (Thammasat University), Thailand.

InCITE 2019 has received more than 75 papers to be presented in this conference. All papers represent four following parallel clusters: Green Design and Innovation, Green Manufacturing and Green Processes, Power System and Green Energy Management, and The Role of IT in Innovation Enhancement. Each cluster supports the main theme of the conference, which is **Enhancing Engineering Innovation Towards A Greener Future.** The engineering innovation is the key to increase our awareness in maintaining the sustainable growth and development in the world.

The Organising Committee of InCITE 2019 would like to express our sincere gratitude for the tremendous supports and contributions from many parties. The supports from The Faculty of Engineering of UBAYA, keynote and plenary speakers, our International Scientific Committee, the Steering and Organising Committees are really acknowledged.

The last but not the least, thank you for your supports, enjoy the conference and we hope through this meeting all of you can extend your networks and collaborations.

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