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THE DESIGN OF ECONOMIC, SOCIAL, AND ENVIRONMENTAL PERFORMANCE MEASUREMENT SYSTEM FOR INDUSTRIAL SUSTAINABILITY

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Abstract

Industrial economic, social, environmental and sustainability performance becomes very important issue at this time, in line with the longterm industrial development goal namely to build industry according to sustainable development concept. This study aims to design industrial performance measurement system of economic, social, environmental and sustainability approaching combination model Sustainability Balanced Scorecard and Labuschagne, and to measure and evaluate the measurement results using Analytical Hierarchy Process, Objective Matrix and Traffic Light System methods. Based on the strategic objectives and industrial needs, formed 33 KPIs (Key Performance Indicators) and 36 sub-KPIs. The measurement and evaluation results of performance in industry ABC obtained performance values each economic perspective 3.4382, environmental perspective 0.2184, social perspective 0.5355 and overall sustainability performance 4.1921 (yellow) which means satisfactory but still far from the target. Thus, it still needs continuous improvement in order to achieve the higher performance as well as to improve industrial competitiveness.

Keywords: Balanced Scorecard, Industry, KPIs, Objective Matrix, Sustainability Performance

1. Introduction

Performance of economic, social, environmental and sustainability performance becomes very important issue at this time, in line with the longterm industrial development goal namely to build industry according to sustainable development concept that meets today's generation needs without compromising the opportunity and ability for future generations (Brundtland, 1987), so the sustainability performance of the industry must continue to be improved and enhanced. Labuschagne, et.al (2005) state that companies that want to compete globally should compile and report the sustainability performance of the overall operations.

ABC's industry is the industry of equipment and components of motor vehicles, the current draft does not have a measurement system of industrial sustainability performance as a whole and integrated yet, therefore the system needs to be designed.

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The Design of Economic, Social, and Environmental Performance Measurement System for Industrial Sustainability

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ABC's industry is the industry of equipment and components of motor vehicles, the current draft does not have a measurement system of industrial sustainability performance as a whole and integrated yet, therefore the system needs to be designed.

Industrial sustainability needs to be designed in such a way using a model which can include economic, social and environmental aspects that is combination *Sustainability Balanced Scorecard - Labuschagne* (SBSC-L) model. While for the measurement and evaluation used *Analytical Hierarchy Process (AHP)* (Saaty, 1993), *Objective Matrix* (OMAX) and *Traffic Light System* (TLS) methods (Neely, et.al, 1995; Vanany, 2009; Riggs, 1987).

Based on explanation above, then it is very important to do the research on the design of performance measurement systems for economic, social, environmental and sustainability in the industry, for performance reparation and increase chronically, so that it can increase the reliance of stakeholders and the competitiveness of industry in both national and global level.

This research aims at (1) Designing a sustainability performance measurement system by using SBSC-L approach model, (2) Measuring and evaluating the measurement results, and (3) Make a proposal for reparation and increase to industrial sustainability.

2. Literature Review

The industry is very essential to broaden the basis of development and meet the needs of the community which is on the rise (Kristanto, 2004). The impact of industry on the environment can reduce the natural carrying capacity which will reduce the ability of nature to support the survival of human beings. According to Salim (2010), conventional development has succeeded in boosting economic growth, but failed in social and environmental aspects. Industrial sustainability is the conceptualization, design and manufacture of goods and services to meet the needs of current generations without compromising the chance of economy, society and environment in the long term (Paramanathan et.al, 2004). Allenby (1999) states that evolution is happening in industrial systems from linear system into cycles system. Production and consumption patterns are sustainable which requires a cycle, mimicking the ecosystem process (Djajadiningrat, et.al., 2004).

Some previous studies have reported the results of their research. Zagloel (2008) emphasized the importance of improvement and enhancement of the industrial performance. Research on the measurement of sustainability performance by using a combination of model approach to *Sustainability Balanced Scorecard* (SBSC) and *Labuschagne* model has been done by Mubin (2012). SBSC model (Figure 1) is the result of the development of the *Balanced Scorecard* (BSC) concept. Understanding the environmental and social strategies are consistent and in accordance with the company is a prerequisite for compiling SBSC (Bieker, 2002; Figge, 2002a; 2002b).

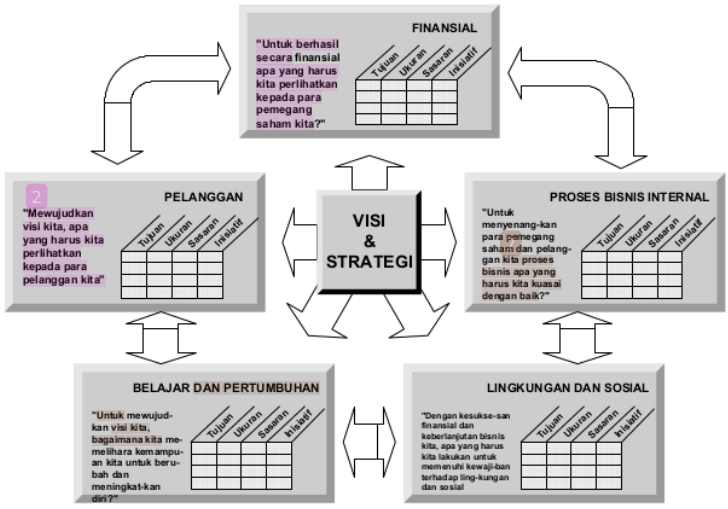

Figure1. SBSC Design
(Kaplan and Norton, 2000; Bieker, 2002)

Some related research has also been done. Figge, et.al. (2002a) suggest that the management of sustainability with the Balanced Scorecard helps to overcome the shortcoming of conventional approach. Dias-Sardinha, et.al. (2002) propose six key strategic objectives for the environmental perspective. In this approach, added a fifth perspective i.e. eco perspective which is different with *Balanced Scorecard*. Tamayao, et.al. (2009) was developing and evaluating the sustainability planning platform.

Furthermore in the planning of Measurement System of *Sustainability Performance* (SPSP), each perspective and component was reduced to strategic goals and *Key Performance Indicator* (KPI). While to measure and evaluate *Sustainability Performance* used *Analytical Hierarchy Process* (AHP) and *Objective Matrix* (OMAX) approach.

3. Research Method

Problem-solving framework in this study is divided into five phases, i.e: (1) preliminary research phase; (2) designing measurement system phase of *sustainability performance* by using SBSC-L model; (3) measurement and evaluation phase of *sustainability performance* by using AHP, OMAX and TLS method; (4) analysis phase; and (5) retrieval conclusion phase.

4. Result And Discussion

4.1. Strategic Goals Determination

To interpret the strategy into action steps (operational) a comprehensive and coherent approach is required SBSC-L model. By the framework of SBSC-L, later determined the three strategic objectives, namely; (1) economic, (2) environment, and (3) social perspective.

4.2. KPI Determination

KPI (*Key Performance Indicator*) is determined through interviews, discussions and investigation of internal documents that describe the industrial system. KPI is defined for each economic, environmental, and social perspective. Appropriate strategic goals of KPI are full presented on Table 1.

Table 1. *Key Performance Indicator* (KPI)

KPI	Description	KPI	Description
KPI 1	: *Profit Margin*	KPI 13	: Utilization Rate of Air Emission
KPI 2	: *Current Ratio*	KPI 14	: The Amount and Utilization of Primary Liquid Waste
KPI 3	: *Quick Ratio*	KPI 14a	: The Amount of Primary Liquid Waste
KPI 4	: ROI (*Return On Investment*)	KPI 14b	: The Utilization Level of Primary Liquid Waste
KPI 5	: ROCE (*Return On Capital Employed*)	KPI 15	: The Quality of Primary Liquid Waste
KPI 6	: Water Usage	KPI 15a	: pH (The Degree of Acidity)
KPI 6a	: The Amount of Water Used	KPI 15b	: BOD (*Biochemical Oxygen Demand*)
KPI 6b	: The Quality Level of Water Used	KPI 15c	: COD (*Chemical Oxygen Demand*)
KPI 6c	: Percent of water from The Industrial Symbiosis Results (cooperation between industry)	KPI 15d	: TSS (*Total Suspended Solid*)
KPI 7	: Energy Usage	KPI 15e	: NH_3 (Ammonia)
KPI 7a	: The Amount of Energy Used	KPI 15f	: H_2S (Hydrogen Sulfide)
KPI 7b	: The Level of Energy Efficiency	KPI 16	: The Amount and Utilization of Primary Solid Waste
KPI 7c	: Percent Energy from Industrial Symbiosis Results	KPI 16a	: The Amount of Primary Solid Waste
KPI 8	: The Use of Primary Raw Materials	KPI 16b	: The Utilization Level of Primary Solid Waste
KPI 8a	: The Amount of Primary Raw Materials	KPI 17	: Work Climate: Wet & Ball Temperature Index (WBTI)
KPI 8b	: The Quality Level of Primary	KPI 18	: The Frequency of Inspection

	Raw Materials		Equipment K3

Table 1. *Key Performance Indicator* (KPI) (Cont.)

KPI	Description	KPI	Description
KPI 8c	: Percent of Raw Materials from the Industrial ResultsSymbiosis	KPI 19	: The Frequency of Medical Examination of the Employees
KPI 9	: Production of Capacity and Quality Products	KPI 20	: Percent of Employees who wear Self Protection Tools
KPI 9a	: Capacity Production of Primary Product	KPI 21	: The Number of Environmental Performance Awards
KPI 9b	: The Quality Level of Primary Product	KPI 22	: Environmental Performance Assessment Rating
KPI 10	: Number of & utilization of *by-Product* (Side Product)	KPI 23	: The Number of Environmental Auditing Programme
KPI 10a	: The Amount of Primary *by-Product*	KPI 24	: The Employee Productivity Level
KPI 10b	: The Quality Level of Primary *by-Product*	KPI 25	: The Employee's Creativity and Innovation Level
KPI 10c	: Percent *by-Product* is utilized by other industries	KPI 26	: Employee Job Satisfaction Level
KPI 11	: Ambient Air Quality	KPI 27	: The Number of Employee Training
KPI 11a	: SO_2 (Sulfur Dioxide)	KPI 28	: The Level of Employee Accomplishments
KPI 11b	: CO (Carbon Monoxide)	KPI 29	: Level (Index) of a Smooth Flow of Information & Communication
KPI 11c	: NOx (Nitrogen Oxide)	KPI 30	: The Amount of Venture Capital Support and other Assistance Provided to the Community
KPI 11d	: H_2S (Hydrogen Sulfide)	KPI 31	: The Number of Students/Scholars who do Research/Internship/PKN
KPI 11e	: Dust or Solid Particles	KPI 32	: The Level of Public Perception and Participation
KPI 12	: Emission of Air Quality and in Production Room	KPI 33	: The Level of Satisfaction of the Society to the Existence of the Company
KPI 12a	: NH_3 (Ammonia)		
KPI 12b	: SO_2 (Sulfur Dioxide)		
KPI 12c	: CO (Carbon Monoxide)		
KPI 12d	: NOx (Nitrogen Oxide)		
KPI 12e	: H_2S (Hydrogen Sulfide)		
KPI 12f	: Dust		
KPI 12g	: Noise Level		

4.3. KPI Weighting

Weighting was done based on the results of questionnaire from the respondents of the industry, by using *Analytical Hierarchy Process* (AHP) method. Results processing with AHP software obtained weights for each perspective, with a Inconsistenscy Ratio (IR) of 0.05 or 5%, so the results of weighting was feasible and acceptable (the admission criteria: IR < 10%).

4.4. Analysis of the Measurement Results and the Assessment of *Sustainability Performance*

Based on the results of measurement and assessment of *Sustainability Performance* on ABC'S industry by using OMAX and TLS method obtained performance value in each perspective and value to overall sustainability performance of industry. The value of the performance of economic perspective is 3,4382 with a performance index 1,42, environmental perspective 0,2184 with a performance index 0,0714, social perspective 0,5355 with a performance index 0,1392 and *overall sustainability performance* 4,1921 (yellow) which means "satisfying with a total performance index 1,6306".

The value of the performance of environmental and social perspective are still relatively low compared to the economic perspectives due to performance data of the environmental and social perspective not yet available, besides there are also still some KPIs and sub KPIs are mainly for the environmental perspective that still has a low value (red), partly because it has failed to meet the standard of quality defined.

Conclusion

Results from outlining strategic goals (strategic objectives) ABC industry in each of the three strategic goals of economic perspective, environmental perspective has 4 strategic goals, and social perspective has 3 strategic goals, bringing the total retrieved 10 strategic goals.

Based on strategic goals and needs of the industry, formed 33 KPIs (*Key Performance Indicator*) and 36 sub-division of KPIs, consists of 5 KPIs on economic perspective, 18 KPIs and 36 sub-division of KPIs on environmental perspective, and 10 KPIs on social perspective.

Results of weighting on the perspective obtained each economic perspective is 0,413, environmental perspective is 0,327, and social perspective is 0,260, it means that the economic aspect is still a priority for ABC industry without neglecting the environmental and social aspects.

The results of measurement and assessment of *Sustainability Performance* on an ABC industry obtained the value of performance for economic perspectives is 3,4382 with a performance index 1.42, environmental perspectives 0,2184 with a performance index 0,0714, social perspective is 0,5355 with a performance index 0,1392 and overall sustainability performance is 4,1921 (yellow) which means

"satisfying but still far from the target". Thus, it still needed improvement and increase continuously (continuous improvement) in order to achieve a higher performance rating again at once can increase its competitiveness.

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