

Performance measurement of sustainable supply chain management (SSCM) in newly established cocoa-processing company in Southeast Sulawesi, Indonesia

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Abstract: This research aimed to determine the sustainability of supply chain management in Cocoa-Processing company in Southeast Sulawesi, Indonesia. Southeast Sulawesi is one of the biggest produces in Indonesia, and this newly established company planned to utilise this valuable resources, cocoa plantation. The company produces intermediate products of cocoa: liquor, butter, cake, and powder. Even the company is in the early stages of business, it is trying to apply sustainability to the supply chain. The company see this necessary as a competitive advantage in the industry. To evaluate the applied sustainable supply chain, a performance measurement is being done to see how well sustainable supply chain run is. A Sustainability Balanced Scorecard (SBSC) is used to measure. Key Performance Indicators (KPI) are designed from brainstorming with the company and elaboration from company's vision and mission. The structure of SBSC for SSCM was the modification of initial balanced scorecard by adding Suppliers perspective and Non-market perspective. All KPIs is then pair-compared to get the prioritised weighted score using Analytical Hierarchy Process (AHP). KPI scores are calculated by using "Target/ Actual" scoring system. The results showed that the company's SSCM is not well performed. Over half of the KPIs are under performance. Continues improvement is needed to increase company's SSCM performance and keep the sustainability of cocoa production.

Keywords: Cocoa, KPI, SBSC, SSCM

Introduction

Indonesia is one of the largest cocoa producers in the world besides Ghana and Ivory Coast [1]. Cocoa become a flagship commodity that gives the country a significant foreign exchange around USD 1.05 billion in 2015 after Palm Oil and Rubber crops [2]. Besides utilised in domestic, cocoa beans are also exported to foreign countries such as Malaysia, United States, Singapore, Brazil, Republic of China, and European Union [3]. Southeast Sulawesi is one of a region which produces the biggest cocoa which produced cocoa approximately 250.000 tons in 2013 [3]. Unfortunately, there was no organisation facilitate the cocoa processing massively. This newly established company could see this opportunity to empower the available resources of cocoa commodity.

Sustainability has expanded in various areas of development, such as business, infrastructure, industry, technology, agriculture and many other areas. It rises from the social needs that always volatile, and all element of society are strived to those changes. The most perceived change is environmental destruction that can harm our planet, the place where we live. The concept is then adapted in all field. The company realised that sustainability becomes an important aspect for manufacturing company these days. Sustainability is holding an important role for the improvement of supply chain management of an organisation. It integrates economic, social, and environmental aspects for performance goals [4]. Many critiques questioning the sustainability of cocoa industry. Lack of ecological sustainability [5], child labor issue [5], manufacturing sustainability, which all those affect the company's financial.

Cocoa processing industry has a large complex supply chain from the upstream (suppliers; mostly farmers) to the downstream (customers; cocoa finished product company). Furthermore, SCM has been recognised as a key concept for the agrifood industry competitiveness [6]. Cocoa supply system is different with the palm oil where the palm oil industry generally has their own plantation to supply the mill, so they could easily control the supply. In the contrary, cocoa beans is supplied from plantation owned by local farmers. Therefore, the industry should be able to maintain partnership with farmers to continuously supply the mill. Another challenges for the industry to face in is to improve

and preserve the beans quality produced by the farmers. Mostly, the farmers do not know how to process the bean in correct procedure. Even they knew the procedure, they are too lazy to do it because it takes their time. Sustainable SCM expands the concepts of sustainability from a company [7] by providing tools for improving company's supply chain and fulfilling stakeholders' demands for company's competitiveness, sustainability, and responsibility [8]. One of the "Key Thrusts" developed by ERA (European Research Area) [6] indicates food chains need to operate in a manner that exploits and optimises the synergies among environmental protection, social fairness, and economic growth. Therefore, the company is trying to implement sustainability along their development through the supply chain. The sustainable agricultural supply chain is also rarely discussed, it is estimated that only one-tenth of the total literature that discussed sustainable supply chain [9].

Method

This study used qualitative approaches which data is mainly gathered by interviewing and brainstorming with related stakeholders to design Key Performance Indicators (KPI) of SSCM. The KPI used as a framework for the company's Sustainability Balanced Scorecard to establish the link of sustainability in the supply chain. The KPI is divided into six perspectives: Financial Perspective, Customer Perspective, Internal Process Perspective, Supplier Perspective, Learning and Growth Perspective, and Non-Market Perspective. Environmental and non-environmental aspects were added to identify the sustainability within the KPI. Quantitative data is collected for measuring SSCM performance. Questionnaire is distributed to company's SCM expertise for KPI pairwise comparison in order to get priority weights of each KPI by using Analytical Hierarchy Process. The expertise are suppliers, managers/ head departments, and a customer. A road map is provided which shows the relations between KPI. The weighted score is calculated by using "Target/Actual" scoring system as formulated in Table 1 and categorised the final score result using Traffic Light System as shown in Table 2. The score limitation for the Traffic Light is decided by the company.

Table 1: KPI Scoring System [10]

Condition	Score (%)
Higher is better	$(\text{actual} / \text{target}) \times 100\%$
Lower is better	$(2 - (\text{actual} / \text{target})) \times 100\%$
Must be zero	100 if actual = 0 or 0 if actual \neq 0 or 100 if actual = No (Yes/No question) or 0 if actual = Yes (Yes/No question)
Must be one	100 if actual = 1 or 0 if actual \neq 1 or 100 if actual = Yes (Yes/No question) or 0 if actual = No (Yes/No question)

Table 2: Traffic Light System

Traffic Light	Remarks
Red	KPI is under performance or has not been implemented at all which KPI Scores \leq 60
Yellow	KPI almost meet the target then it should be improved which $60 < \text{KPI Scores} \leq 80$
Green	KPI has meet the target, even surpass the target expected which KPI Scores > 80

Results and Discussion

The company processes cocoa into several intermediate products: liquor, butter, cake, and powder. Its suppliers are farmers and collectors (who are collect cocoa beans from farmers) are spread in almost all regions of cocoa producers in Southeast Sulawesi. The company is in the early stages of business, thus it found difficulties to find farmers to be partnered because there are many current competitors have taken over almost half of the cocoa plantation in Southeast Sulawesi. The suppliers supply cocoa beans in various condition (quality). The company accept all beans which are fermented and non-fermented beans. However, this beans quality becomes a challenge to be faced for the company. It needs to figure out how to obtain the same quality beans matched with company's

standard from all suppliers. Each farmers produces different quality of beans, even some of them did not know how to treat the beans correctly. Suppliers must be delivered the beans to the factory within specified times. There will be consequences if they send it out of the time scheduled. All beans received and placed in raw material warehouse. The company organised the raw material sacks by lot system. It categorised the beans sacks according to time arrived, from which suppliers, and type of beans quality. Beans are executed as First In First Out (FIFO) because agricultural product has limited shelf-life.

The beans then go to production process where in this factory, it only has one production line. So, there will be bottle neck if there is downtime in one machine. The company applied preventive maintenance to avoid any machine errors and optimising the production process. During the production process, beans quality is checked regularly every one hour to avoid and to find out any product defect by the Quality Assurance (QA). The company has obtained Halal certificate, HACCP, and has applied Good Manufacturing Process (GMP). The company still striving to get ISO 9000 and ISO 22000 for quality assurance. The company is also paying attention to occupational health and safety (OHS) for its employees particularly during the production process. All employees are required to use safety equipment when entering the production facility. Unfortunately, the company has not had OHS certification (ISO 18000). The company produces beans shells as its wastes. In order to build reputation as a zero waste company, it sold the shells to domestic buyer to be processed as animal feed.

The company admitted that it is in bottom-line. This is because it still in the early stage of business, the production process is not stable yet due to limited beans supply, and the internal condition of the company still need to be improved. From the past two years until now, 100% of their product were exported to Europe. In the future, it targets domestic confectionary company like Nestle, Delfi, and Arnotts. To accomplish those goals, they still need to overcome lack of raw materials supply and optimise the production operation. The finished products are shipped by the third party (transportation vendor). The company claimed that any product damages caused during shipping is not company responsibility.

From the description of company's current situation of supply chain management, and integrating it with vision and mission from the company, Strategic road map of SSCM SBSC illustrated in Fig. 1, and SSCM KPIs can be constructed as Table 3 below.

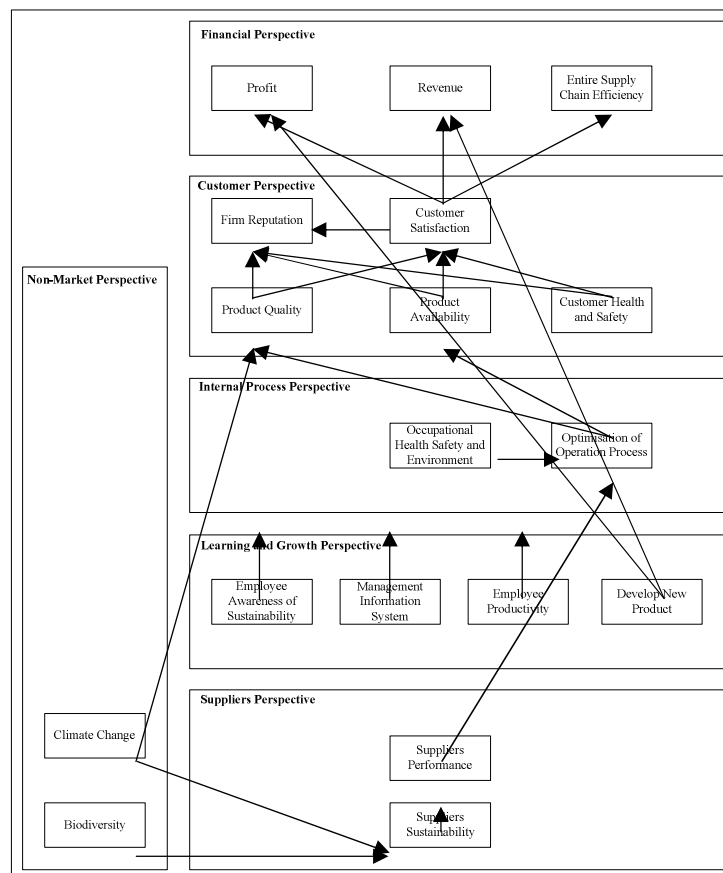


Fig. 1: Strategic Road Map of Sustainable Supply Chain Management Balanced Scorecard

Table 3: Company's Key Performance Indicators of Sustainable Supply Chain Management

Perspectives	Strategic Objectives	Key Performance Indicators				
		Non-environmental		Environmental		
Financial	F1	Profit Earnings for Entire Supply Chain	F1a	Profit /year		
	F2	Revenue Growth	F2a	Revenue /year		
	F3	Increasing SC Efficiency	F3a	Labor costs /year	F3e	Energy Costs /year
			F3b	Proportion of spending on local suppliers		
			F3c	Working capital Efficiency		
		F3d	Fixed capital Efficiency			
Customer	C1	Customer Satisfaction	C1a	Annual number of customer complaints		
	C2	Firm Reputation	C1b	On-time delivery (%)		
			C2a	Total sales invented for social project		
	C3	Product Quality	C2b	Number of new customers	C3a	Quality Guarantee
					C3b	Number of Reject Products /year
C4	Customer Health and Safety			C3c	Defect product Rate /year	
C5	Product Availability	C5a	Meet the production capacity per target production	C4a	Food Safety Certificate	
Internal Process	IP1	Operation Process Optimisation	IP1a	Manufacturing Lead Time	IP1d	Ratios of emission carbon
			IP1b	Down time rate /year	IP1e	Wastes produced
			IP1c	Production Planning Accuracy	IP1f	Energy Consumption
	IP2	Healthier Working Environment			IP2a	Noise and Vibration
					IP2b	Hazardous Material Used
				IP2c	Occupational Health & Safety Certificate	
				IP2d	Safety Environment Certificate	
Learning and Growth	IP3	Safer Warehouse and Transportation	IP3a	Employees Accident		
	LG1	Employees Productivity	LG1a	Training for skilled employees		
	LG2	Employees Awareness of Social and Environmental issues	LG1b	Work load completed	LG2a	Sustainability training for employees
					LG3a	product variety
LG4	Management Information Systems	LG4a	Use of data processing synergies			
Suppliers	S1	Supplier Performance	S1a	Supplier On-time delivery	S1c	New suppliers screened by using environmental and labor practices aspects
	S2	Make suppliers more sustainable	S1b	Supplier relationship/ communication	S2a	Sustainability training and education for suppliers
Non-Market	NM1	Climate Change			NM1a	Weather Forecast Accuracy
	NM2	Biodiversity			NM2a	Diversity Index

- a. Perspective Financial
Financial performance measurement gives an idea whether the company SCM strategy, implementation and execution contributed or not to the increase of corporate profits.
- b. Perspective Customer
This perspective describes the appearance of the organization in the eyes of customers. This perspective should be able to measure the conditions and expectations of customers towards the products and services carried out in the company's business operations.
- c. Perspective Internal Process
This perspective focuses on the internal processes that will impact the company's supply chain, from supplier to end customer in order to achieve the financial objectives of the company with the aspect of sustainability.

- d. Perspective Learning and Growth
This Perspective focuses on the system and the actors as company's strategy for the development of supply chain related to sustainability.
- e. Perspective Suppliers
This perspective describes how is the supplier efforts to meet the client requirement, increasing supplier performance to keep consumer trusts. A company/factory is a customer for the suppliers.
- f. Perspective Non-Market
This perspective shows the strategic issues that may affect the SCM process, but not related to the enterprise market

The calculation of KPI scores resulted that many of KPI is highlighted in red particularly related to sustainability, as shown in Table 4. It indicates that the KPI is poorly performed, some KPI even has not been implemented yet. Some KPIs are considered as non-critical, thus its implementation can be done over time adjusted with the condition of the company. The non-critical KPIs are total sales invented for social project, ratios of carbon emission, sustainability training for employees, new suppliers screened based on environmental and labor practices aspects, weather forecast accuracy, and biodiversity index.

Table 4: Red Highlighted KPIs of SSCM

Key Performance Indicators	Weight (%)	Target	Actual	Scoring System	Scores	Weighted Scores
F1a Profit /year	100	10,000,000,000	0	Higher is better	0	0.00
F2a Revenue /year	100	0	0	Higher is better	0	0.00
F3e Energy Costs /year	22.4		has not counted yet	Lower is better	0	0.00
C2a Total sales invented for social project	50	5%	0%	Higher is better	0	0.00
C3b Number of Reject Products /year	33.3	10%	50%	Lower is better	-300	-99.90
C4a Food Safety Certificate	100	4 certificates	2 certificates	Higher is better	50	50.00
IP1a Manufacturing Lead Time	24.5	14 hours	20 hours	Lower is better	0	0.00
IP1b Down time rate /year	19.3	5%	10%	Lower is better	0	0.00
IP1c Production Planning Accuracy	26.3	100%	35%	Higher is better	35	9.21
IP1d Ratios of emission carbon	10		has not counted yet	Lower is better	0	0.00
IP1f Energy Consumption	10		has not counted yet	Lower is better	0	0.00
IP2c Occupational Health & Safety Certificate	25	2 certificates	0 certificate	Higher is better	0	0.00
IP2d Safety Environment Certificate	25	1 certificate	0 certificate	Higher is better	0	0.00
LG1a Training for skilled employees	50	All skilled employees (100%)	20%	Higher is better	20	10.00
LG2a Sustainability training for employees /year	100	2 times	0 times	Higher is better	0	0.00
S1c New suppliers screened by using environmental and labor practices aspects	24	50 supplier	20 supplier	Higher is better	40	9.60
S2a Sustainability training and education for suppliers	100	80%	20%	Higher is better	25	25.00
NM1a Weather Forecast Accuracy	100	0%	0%	Higher is better	0	0.00
NM2a Diversity Index	100	0	0	Higher is better	0	0.00

From the performance measurement above, shows that the company has not implement sustainability thoroughly in its supply chain. Some of those KPI, which have not implemented or underperformed, are essential for a manufacturing company. Mostly, the unimplemented KPI are environmental sustainability such as profit and revenue, reject product, food safety, manufacturing lead time and downtime, energy consumption, occupational health safety and environment (OHS), and supplier sustainability in farming and cocoa beans treatment. These are due to lack of resources and knowledge about the importance of sustainability.

- a. Profit and revenue. The company suffered losses because of it lacks of raw materials, and there were some products rejected due to unmet customer specification. The company in in bottom-line, since it still grappling with the market. There are some strategies that the Queensland Government [11] suggests to increase sales, so that could improve company's profit and revenue:
 - Increase employees productivity, reward the employees is important to motivate them so that they could give their best to do the job. Training/ workshop for jobs requiring specified skills.
 - Develop sustainable new product lines. Survey the customers about new products, and discover market trends. For this company, considers producing finished products, ready for consumption. However, it will take years to be implemented.
 - Find new customers or new markets. Do market research about expanding the business. Try to find local customers instead of sold all the products for export. Suppliers is also customers, find new suppliers, if they could not fulfil the raw materials specification (quality), the company can train them under mutual agreement.
 - Pricing strategy. If possible, increase the products price without reducing sales or apply price discounts for the purchase in certain amount. For raw materials purchasing, ask for price discounts or check the raw materials thoroughly, if there is any damage, ask for lower prices.
- b. Reject product. Quality control procedure is needed to prevent any product defects that cause rejection. Unfortunately, as massive cocoa-processing, the QA could check the all the product, all the time. It is just randomly checked in regular basis. The company should find the source of the defect by using any tools that has many references for it (e.g. Six Sigma) or hire an Industrial Engineer/ consultant [12]. Other important thing is this company should have ISO 9000 which it is essential for a manufacturing company.
- c. Food safety. It is needed since the company produces consumable goods. Currently, the company has obtained Halal Certificate, applied HACCP and GMP. It also gives a quality guarantee if the customer asked. Unfortunately, the company misses ISO 22000 which it is for food industry that could gain customer trusts.
- d. Manufacturing lead time and downtime. Gunasekaran, et. al [13] mentioned group technology could be one way to reduce process cycle time. However, it is impossible to apply in this company because they only have one production line. The other ways are by applying preventive maintenance to avoid any errors and finding the source of the machine trouble. The company should calculate the reliability of each machine and Overall Equipment Effectiveness (OEE) for the whole production process.
- e. Energy consumption. The company realised that calculating the energy consumption is necessary, since it could eliminate unnecessary consumption, which can save their utilisation costs. The energy consumption could be a waste if excessively used and will affect environmentally and financially [14].
- f. Occupational health safety and environment. A safe healthy working environment is a standard for any manufacturing company. OHS is essential to create a safe working environment, to avoid any accidents in the factory [15]. The company are still striving to obtain ISO 18000 about safety environment. The company should also preserved the environment of its surrounding area by keep it clean and tidy, and sterilised the factory area from any insects/bugs like flies and ants because of cocoa flavour attracts those animals.
- g. Suppliers sustainability. This KPI is the most crucial one among others, because supplier is one of the key actors in the supply chain. Cocoa beans quality is determined from suppliers supplies. This company has a two-year sustainability training for suppliers, which it teaches them how to treat the beans properly and how to rejuvenate the plantation to keep the cocoa sustainability. This will indirectly improve the lives of cocoa farmers financially. However, the company is unsure that all of the suppliers could implement the sustainability, this should assisted with continuous monitoring. Besides sustainability, the child labor issue in the cocoa plantation that has become the main concern in the cocoa industry should become an attention for the company [5]. Ensuring that your chocolate product is child labor free is important for the customer these days. Fortunately, the suppliers plantation is ethically grown. However, it should be better if the company could get a Fair Trade label. Fair Trade could be obtained if the company treats their suppliers well, better purchasing prices, ethical working conditions, and farmers/ workers are fairly traded and treated [16].

Conclusions

The sustainable supply chain management runs by the company has not perfected yet. There are still many weaknesses either in supply chain actors or in the supply chain sections. Though sustainability is a developed concept, this should be best applied in the early stages of a company when it already has a solid foundation. Sustainability can be applied in the internal process first then forward it to the other part of supply chain. Sustainability is now becoming a spotlight in the business, so customer could see this as strength of a company to deal with. In cocoa industry, mostly the customer wants their ordered product is meet their standard, safe consumed, and Fair Traded. This will be very beneficial for all parts of the supply chain. The designed KPI can be converted into strategies that the company could use to improve their sustainable SCM.

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