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# An Analysis of Feasibility of The Appropriate Technology Investment and Green Supply Chain Management Planning on Moringa Products

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**Abstract**—Moringa, especially moringa flour, is a featured product in Sumenep, Madura. To possibly enter global market, technological investment support and managerial improvements are strongly required. One of which is by implementing Green Supply Chain Management (GSCM). This study aims to analyze the feasibility on the appropriate technology investment and GSCM implementation. The results indicated that appropriate technology investment in flour makers technology, packaging design, and waste treatment technology was feasible and implementable, yet the GSCM implementation was not fully performed. The success in implementing GSCM to support the featured products required firm support and joint commitment of suppliers, customers, local governments, as well as SMEs actors.

**Keywords**—*featured product, feasibility analysis, Green Supply Chain Management.*

## I. INTRODUCTION

Regional featured products are products both goods and services, produced by cooperatives and SMEs with potential to be developed by utilizing all regional resources, from natural resources, human resources to local culture. They bring income to both society and government and are expected to be an economic force for the region and local communities due to competitiveness, selling power, and driving force to enter global market [1]. Undeniably, SMEs have important role in developing featured products as well as Indonesian economy. The SMEs contribution to Indonesia's Gross Domestic Product was 61.41% in 2017. However, in export it was only 15.7%, stated lower than Vietnam, Malaysia, and Thailand as 17%, 28%, and 35% respectively [2]. It shows that SMEs products have low market competitiveness in global market. Therefore, a strategy is needed to increase attractiveness, resilience, and competitiveness of various local products produced by SMEs. Although local SMEs are quite in global market, they are adaptable to adopt appropriate technologies. Several studies showed that the ability of technology adoption was strongly related to the roles of SMEs actors and organizational characteristics to accept changes and evolve accordingly [3], [4]. Besides, from study conducted Sahoo and Yadav [5], it found that total quality management was proved to significantly influence the industrial performances of SMEs in India.

To enter global market, SMEs should have the ability to meet the global market demands by strengthening product brands, saving production costs and energy efficiency, selling low cost goods, contributing to reduce carbon emissions, and increasing productivity of production process [6]. The dynamic of global and environment is unpredictable, so it challenges business actors to compete in global market. Therefore, they shift their focus to build a strong collaborative supply chain. Effective collaboration with supply chain partners requires organizations to share valuable information in real time [7]. SMEs have several advantages in implementing supply chain management (SCM) due to their independence and their organization characteristics of a flat organization structure. Its flexibility makes SMEs possibly to accept changes and implement management changes directly after starting SCM [3]. In addition, multinational companies began to accept the need for environmental management and to implement environmental management programs to compete in global market [8]. Green Supply Chain Management (GSCM) is a form of operational initiation to address environmental problems carried out by many organizations in the Southeast Asia region [9]. Studies conducted by Vijayvargy et al. [10] indicate that the size of the organization has a significant impact in adopting the application of GSCM in India. Through a very in-depth meta-analysis, Geng et al. [11] concluded that in Asian Emerging Economies (AEE), GSCM practices lead to better performance in four aspects, namely: economic, environmental, operational, and social performance.

One of the local potentials in East Java Province potentially developed for national industry is processed Moringa (moringa oliefera lam) in Sumenep, Madura. At first, Moringa was planted by local government to overcome critical land in Sumenep, so they were easily found mostly in all sub-districts. There are 12 species of Moringa planted in this region, however only 1 species is cultivated and possibly utilized into various processed products by local SMEs.

There are various products of Moringa, including Moringa sticks, Moringa noodles, the Moringa, Moringa capsules, and Moringa flour. The main raw material is Moringa flour made from Moringa leaves. Every month, they produced 1,000 packages of Moringa sticks, 500 packages of Moringa noodles, and 1,000 kg of Moringa flour. Yet it was less than the demands as it is up to 5 tons per month. Market demand

for Moringa flour is widely opened, so the most needed technology is Moringa flour makers. This machine should be hygienic in order to pass the international market health screening. One of which is by using stainless steel for the surface of grinding machine. In addition, for the optimal production, the machine should have a capacity of 250 kg/hour with a particle fineness of 260 mesh. The greater the production produced, the better the impact on the implementation of its supply chain was. This study aims to analyze the investment feasibility of Moringa flour maker as a manifestation of the SMEs' ability in adopting technology as well as GCSM implementation of the SMEs actors of Moringa products in Sumenep-Madura.

## II. RESEARCH METHODS

This study applied two approaches, namely investment project evaluation in capital budgeting and qualitative analysis to understand the GSCM implementation. Qualitative research focused on phenomena occurring in natural settings where it was done in the field or wherever participants usually did their activities or widely recognized as field research [12]. In this study, GSCM practice planning adopted from Vijayvargy et al. [10] with 21 statement items:

- Environmental-based quality certification
- The existence of an environmental management system
- Compliance and environmental audit programs
- Total quality environmental management
- Cross-functional companies for environmental improvement
- Support for GSCM from mid-level managers
- GSCM commitment from senior managers
- Cooperation with suppliers for environmental purposes
- Environmental audit for internal management suppliers
- Design specifications provision to suppliers including environmental requirements for goods purchased
- Suppliers who have ISO 14001 certification
- Second level environmentally friendly supplier evaluation
- Collaborate with customers for eco-design
- Collaborate with customers for cleaner production
- Collaboration with customers for green packaging
- Product design to reduce material/energy consumption
- Product design for reuse, recycle, recovery of materials and component parts.
- Product design to avoid or reduce the use of hazardous products and manufacturing processes.
- Investments recovery (sales), excessive supplies/materials

- Sales of waste and used materials
- Excessive capital equipment sales

The method often used to evaluate investment projects is by calculating the Net Present Value (NPV) and Internal Rate of Return (IRR). This calculation was on ten months cash flow within three years at SMEs Nurul Jannah and Kamboja in Sumenep-Madura, East Java. The investment feasibility analysis was carried out per project per year considering the different types of investments each year.

### A. Net Present Value (NPV)

Net Present Value is a discounted cash flow approach to capital budgeting. The net present value (NPV) of an investment proposal is the present value of the proposal's net cash flows less the proposal's initial cash outflow [13]:

$$NPV = \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \dots + \frac{CF_n}{(1+k)^n} - ICO \quad (1)$$

NPV = net present value

ICO = initial cash outflow at time 0

CF<sub>n</sub> = net cash inflow during the period n

k = discount rate

Investment considered feasible if NPV > 0 with 10% of discount rate value.

### B. Internal Rate of Return (IRR)

Internal Rate of Return represents the discount rate which equates the present value of the expected net cash flow (CF) with the initial cash outflow (ICO). In other words, the IRR value is the discount rate that makes the current net value (NPV) of all cash flows from a particular project equal to zero. The IRR approach uses formulas [13]:

$$ICO = \frac{CF_1}{(1+IRR)^1} + \frac{CF_2}{(1+IRR)^2} + \dots + \frac{CF_n}{(1+IRR)^n} \quad (2)$$

IRR = internal rate of return

ICO = initial cash outflow at time 0

CF<sub>n</sub> = net cash inflow during the period n

Investment considered feasible if NPV = 0 and exceeds the discount rate specified (> 10%) .

## III. RESULTS AND DISCUSSION

### A. Feasibility Analysis of Moringa Flour Maker Investment

To find the investment feasibility, the expenditure was first calculated (consisting of equipment, raw material/auxiliary costs, labor, and marketing) and income (sales of Moringa

sticks, Moringa noodles, Moringa capsules, Moringa tea, Moringa flour packaging, and Moringa flour bulk packaging) per year as seen in Table I.

TABLE I. EXPENDITURE CALCULATION OF 2018

No	Activity	Number	Unit	Price (IDR)	Total (IDR)
1	<b>Machine Investment:</b>				
	Designing disc mill machine	1	Unit (2 items)	24,300,000	24,300,000
2	<b>Equipment</b>	-	-	-	-
3	<b>Sites</b>	-	-	-	-
4	<b>Supporting raw materials:</b>				
	Fresh moringa leaves	1000	kg	3,000	2,000,000
	4500 watt electricity and water	1		4,000,000	4,000,000
	LPG	10	tube	39,000	390,000
	Moringa Stick packaging	1800	package	850	1,530,000
	Moringa noodles packaging	750	package	850	637,500
	Moringa capsule packaging	300	bottle	3,500	1,050,000
	Moringa tea packaging	250	package	1,500	375,000
	Moringa flour packaging 100 g	800	package	50	680,000
	Moringa bulk flour packaging 1.7 kg	150	package	250	37,500
	Transportation cost	1		1,500,000	1,500,000
5	<b>Labor Cost</b>				
	Administration	2	person	1,200,000	2,400,000
	Production				
	Harvesting (male)	9	person	60,000	5,400,000
	Harvesting (female)	3	person	50,000	1,500,000
	Peeling (female)	5	person	55,000	6,875,000
	Marketing	2	person	1,000,000	2,000,000
	Total Cost <sup>a</sup>				40,375,000

<sup>a</sup> Excluding investment

Table I shows the expenditure details. There is no expenditure on land rent considering that all land used for production is self-owned. Likewise, equipment other than investment in flour maker machines was not invested so it was excluded. Table II shows the income derived from the sale of different types of products. In the same way, the calculation is carried out until 2020. Table III is a summary of Table I and

Table II and shows that profits increase along with the investment invested.

TABLE II. EXPENSES CALCULATION OF 2018

No	Activity	Number	Unit	Price (IDR)	Total (IDR)
1	Moringa Stick	1800	Package of 100 g	5,000	9,000,000
2	Moringa noodles	750	Package of 160 g	5,000	3,750,000
3	Moringa capsule	300	Bottle @ 60 pieces	50,000	15,000,000
4	Moringa tea	250	Package of 100 g	20,000	5,000,000
5	Moringa flour 100 g	800	Package of 100 g	10,000	8,000,000
6	Moringa bulk flour 1.7 kg	150	Package of 1.7 kg	60,000	9,000,000
Total					49,750,000

TABLE III. EXPENSES-INCOME CALCULATION OF 2018 - 2020

Year	Calculation Result		Profit
	Expenses	Income	
2018	IDR 40,375,000	IDR 49,750,000	IDR 9,375,000
2019	IDR 47,991,250	IDR 60,750,000	IDR 12,758,750
2020	IDR 50,001,750	IDR 69,250,000	IDR 19,248,250

Following analysis was to calculate NPV and IRR value based on cash flow per targeted period (seem in Table IV).

TABLE IV. NPV – IRR CALCULATION OF 2018 - 2020

No	Period	Cash Inflow Year I	Cash Inflow Year II	Cash Inflow Year III
1	Mar-18	-9,176,500	-31,150,000	-30,741,250
2	Apr-18	9,375,000	12,758,750	19,248,750
3	May-18	9,375,000	12,758,750	19,248,750
4	Jun-18	9,375,000	12,758,750	19,248,750
5	Jul-18	9,375,000	12,758,750	19,248,750
6	Aug-18	9,375,000	12,758,750	19,248,750
7	Sep-18	9,375,000	12,758,750	19,248,750
8	Oct-18	9,375,000	12,758,750	19,248,750
9	Nov-18	9,375,000	12,758,750	19,248,750
10	Dec-18	9,375,000	12,758,750	19,248,750

Using Microsoft Excel 2016 program, NPV calculation was carried out resulted on 29,690,848.28 or > 0. Thus, it was concluded that the investment in the first year was two flour maker machines with capacity of 250 kg and 100 kg per hour

was feasible and acceptable. Likewise with the IRR calculation results resulted on 245 of interest rate or higher than the interest rate set (10%) meaning that the investment was acceptable. In the same way, the NPV and IRR for the second and third years were 73,447,945.12 and 39% as well as 110,851,130.17 and 62% respectively. In conclusion, the second year investment in the packaging design and third year in the waste treatment technology were acceptable.

#### B. Green Supply Chain Management Implementation

Demand for Moringa flour in foreign markets is widely opened. However, the production process of Moringa products, especially Moringa flour must meet foreign market requirements, such as environmentally-friendly production. Increasing global awareness of environmental impact on production process has become important aspects not only in developed countries but also in developing countries in Asia [11].

Moringa flour producers who mostly are SMEs have a number of obstacles. In addition, aside from funding and equipment issues, quality assurance requirements in the form of environmental-based quality certification such as ISO 14000 has not been provided, so international standards relating to environmental management especially to help organizations minimize the negative influence of their production activities on the environment including air, water, sound, or land have not been available. Therefore, it is necessary to develop an Environmental Management System as an integrated part of the company's overall management system consisting of a set of systematic arrangements such as organizational structure, responsibilities, procedures, processes, and resources. The environmental management system provides a mechanism to achieve and demonstrate good environmental performance by controlling the environmental impact of activities, products and services. The system can be used to anticipate the development of demands and increase the environmental performance of consumers, as well as to meet the requirements of environmental regulations from the government, especially in foreign markets.

Compliance on the environment has not become a priority for Moringa SMEs. Environmental audit programs have also never been carried out. Plastic packaging which is difficult to decompose naturally is commonly used. Likewise, the principles of total quality environmental management, improvement of the environment between functions within the organization, collaboration with suppliers for environmental purposes (including determining design specifications for suppliers including environmental requirements for goods purchased, selection of suppliers that have ISO 14001 certification, second level environmentally friendly evaluation of suppliers), collaboration with customers for eco-design, collaboration with customers for cleaner production, cooperation with customers for environmentally-friendly packaging, as well as product design to reduce material/energy consumption have not been wholly implemented. It is consistent with studies conducted by AECEN [14] which stated that generally, there were not enough human resources to support effective compliance and environmental enforcement in Indonesia. However, there was a strong desire

and support from middle-level managers and commitment from senior managers (SME actors) desiring to apply GSCM principles. In addition, there have been product design efforts in relation to the principles of reuse, recycle, recovery materials, and component parts, among others, by utilizing production waste by re-processing it into animal feed. Strong commitment has also been applied in terms of efforts to avoid or reduce the use of hazardous products and manufacturing processes. The recovery of investments (sales) of excessive supplies/materials and excessive capital equipment sales did not occur considering the limited capital and equipment owned by SMEs.

#### IV. CONCLUSION

The export opportunity for Moringa products, especially Moringa flour, should be accompanied by the overall GSCM implementation. The findings show that Moringa SMEs were still not able to implement GSCM even though there was strong support and commitment from the owner. The successful GSCM implementation for environmental purposes requires coordination and cooperation as well as strong commitment from various related parties, including suppliers, customers, local governments, and SMEs actors.

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