Performances of the Cocoa Farming Models in Cocoa Bean Supply Chain: A Case Study of *Gapoktan Resopammase* in South Sulawesi, Indonesia

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(Received: April 1, 2015; Reviewed: April 15, 2015; Accepted: May 27, 2015)

Abstract: The research objectives are to evaluate the performances of three cocoa farming models in "so called *Gapoktan" (Combined Farmers Groups)* of *Resopammase's* cocoa supply chain, located in Larompong District, Luwu Regency, South Sulawesi Province, Indonesia. *Resopammase* has organized around 16 of cocoa farming groups (called *poktan*), a kind of village cooperative to produce quality and fermented cocoa beans since several years ago to supply for *PT. Bumi Tangerang Mesindotama* in Tangerang, Banten Province. Data for this researh were derived from field survey, expert survey, and literature study. Evaluation uses Analytic Hierarchy Process (AHP) method. The major finding of this research is that, the cocoa farming model in which the cocoa smallholders sell their cocoa beans in the form of wet- cocoa beans to the *poktan*, which in turn processes the wet-cocoa beans into dry fermented cocoa beans in the Cocoa Processing Center (CPC) before delivering the cocoa beans to *Resopammase*, has the highest overall priority level in performances (0.699), compared to the other two that have the priority levels of.0.196 and 0.136, respectively. The criteria in evaluating the models are respectively quality of the cocoa beans (0.343), continuity of supply (0.216), cocoa farming management (0.194), cost efficiency (0.147), and responsiveness to handle any complaint about quality of the cocoa bean produced (0.099). For the policy makers, this finding can be used as one of the references in the efforts to improve quality and increase production of the cocoa beans of the Indonesia's cocoa farming parallel to the increase in cocoa farmers' income.

Keywords: Cocoa farming model; performances; supply chain

1. Introduction

Since the imposition of export duty up to 15 % policy on the raw cocoa beans exported, effectively since 2010, and the downstream policy of cocoa industry issued in 2010, the structures of the Indonesia's cocoa production has shifted a part from cocoa bean- oriented commodity to some other cocoa- derivated products, both intermediate products, e.g. cocoa liquor, butter, cakes, and powder, and end products, e.g. chocolate foods and drinks. During the period of 2010-2012, cocoa beans exported from Indonesia has decreased from 432.4 thousand ton in 2010 to 210.1 thousand ton in 2011, and then to 163,5 thousand ton in 2012. In the same period export of the cocoa based products has increased from 119,2 thousand ton in 2010 to 195,4 thousand ton in 2011, and 215,7 thousand ton in 2012 *(*Kemenperin*,* 2013). The shifts of the cocoa production structure, of course, will increase the demand side for raw cocoa beans specified for cocoa based and chocolate products. With the cocoa production of 440 thousand ton in 2011/2012, Indonesia contributed for 10.77 % of the world total cocoa production of 4,085 thousand ton (ICCO, 2014).

However, the increase in the demand has not been fully followed by improvement in cocoa bean quality and supply side (Kemenperin, 2013 and Syadullah, 2012). According to Sikumbang (2013), Indonesia in 2014 was predicted to import around 100 thousand ton prime cocoa beans, especially from Ghana to fulfill the installed capacity of the domestic cocoa processing industry. For the cocoa processing industry, sufficient supply of raw cocoa beans both in quality and quantity is a prerequisite to maintain production in an economic scale. The low in quality is indicated by relatively high moisture, and moldy beans contents, and waste and foreign matters of the cocoa beans especially those produced by cocoa smallholders. Most of the cocoa beans has been non-fermented also. As stated by Minifie (1999), only quality and fermented cocoa beans can be processed to chocolate foods and drinks with a specific chocolate flavor.

In spite of this such condition, there are several cocoa production centers which have started to produce quality and fermented cocoa beans in response to the increase in the demand of the quality and fermented cocoa beans. Among of those production center is one located in District of Larompong, Luwu Regency, South Sulawesi Province of Indonesia (Yunus *et al*., 2012).

Resopammase, in so called *gapoktan* in Luwu Regency of South Sulawesi Province has orginized several cocoa farmer groups, called *poktan*, a kind of village cooperatives to produce quality and fermented cocoa beans since 2006, under technical assistance of *Resopammase* both for on-farm and after harvest. *Resopammase* collects the cocoa beans received from the cocoa smallholders or from the poktan (buying by cash), which in turn sell the cocoa beans to PT. Bumi Tangerang Mesindotama, a cocoa processing industry, in Tangerang, Banten Province. Therefore, the marketing aspect is not a problem for the cocoa smallholders. The prices received by the cocoa smallholders or the *poktan* from *Resopammase* depend on the quality of cocoa beans produced (Yunus *et al*., 2012)

In providing cocoa beans to *Resopammase*, the cocoa smallholders either individually or in a group use three different types of cocoa farming models. The types show how the cocoa smallholders process and deliver their cocoa to *Resopammase*. This farming models will eventually form the *Resopammase* cocoa supply chain in supplying cocoa beans to the buyer, in this case PT. Bumi Tangerang Mesindotama (*Dinas Perkebunan, Provinsi Sulawesi Selatan*, 2011). Supply chain is an integrated logistic system in providing goods from raw materials to end-products (Indrajit and Djokopranoto, 2002).

Different from the general cocoa bean supply chains (Sri Mulato, 2012), or the general cocoa marketing channels (Ali and Rukka, 2011), the cocoa bean supply chain in the *Resopammase* case does not involve cocoa village collectors and cocoa district collectors as well. The only actors involve in the supply chain are cocoa smallholders, *poktan*, *Gapoktan Resopammase*, and PT. Bumi Tangerang Mesindotama (*Dinas Perkebunan, Provinsi Sulawesi Selatan*, 2011).

Assuming that the three cocoa farming models have their own characteristics, thus their own performances, this research deals with evaluating the performances of the three models in the *Resopammase*'s cocoa bean supply chain.

2. Research Methods

2.1 Site

The case study is at *Gapoktan Resopammase*, located in District of Larompong, Luwu Regency, South Sulawesi Province, one of the primary cocoa production centers of Indonesia. The field survey and data collection was conducted from September to October 2014.

2.2 Data

Data required for the research was derived from field survey, expert survey, and study of the literatures on the matters i.e. research articles from scientific journals, text books, and research or reports issued by *Dinas Perkebunan (Local Office for Estate)* South Sulawesi. Expert survey was conducted through in- depth interview with cocoa experts, facilitated with a questionnaire. The experts include two researchers, one business actor, and one policy maker from provincial government institution. All the experts have experiences in cocoa fields between 10 and 20 years.

2.3 Evaluation method

Method used to evaluate the performances of the cocoa farming models in the *Resopammase's* cocoa supply chain is Analytic Hierarchy Process or AHP method (Saaty, 2008, and Marimin and Nurul Maghfiroh, 2011). The steps to decompose the evaluation are as follows: 1) define the problem and determine the kind of knowledge sought, 2) structure the evaluation hierarchy from the top with the goal of the evaluation then the objectives from a broad perspective, through the intermediate levels (criteria on which subsequent elements depend) to the lowest level (which are the three cocoa farming models); 3) construct a set of pair wise comparison matrices; each element in an upper level is used to compare the elements

immediately below with respect to it; use the priorities obtained from the comparisons to weigh the priorities in the levels immediately below; do this for every element and then for each element in the level below, add its weighed value and obtained its overall priority, 5) continue the process of weighing and adding until the final priorities of the models in the bottom most level are obtained, and 6) check the consistency ratio of each pairwise comparison set matrix (CR <0.10). For quick and accurate calculation, the steps 3 to 6 use Expert Choice software.

In the *Resopammase* case study, the problem is how to evaluate the performances of the three cocoa farming models, while the objective is to determine the performences of the models, i.e. the priority levels. The fundamental scale, definition, and explanation for pairwise comparison, from 1 to 9 refers to Saaty's pairwise comparison scale (2008). The higher the scale, the stronger importance of one element over another, and vise versa.

The criteria and subcriteria to evaluate the performances of the cocoa farming models refer to experts opinions and to Iphov Kumala (2014), Retno Astuty (2012), Saragih (2002), and Fajariyanto *et al*. (2012) works, with some modifications considering the *Resopammase* case. Definition of each criteria and subcriteria refer to KBBI on line (2014), BSN (2008), Chopra and Meindl (2001), *Kementan* (2009), Retno Astuty (2012), and Iphov Kumala (2014), also with some modifications. The scale values for each pairwise comparison matrix were given by the experts through direct judgement method.

3. Results and Discussion

3.1 Cocoa Farming Models Features

In the first cocoa farming model, each cocoa smallholder processes their cocoa individually in their farms (i.e. fermentation, drying, and sortation), and sell directly the cocoa beans they produce in a relatively low quality, and small quantity to *Gapoktan Resopammase*. For now, their *poktan* have seemed in "inactive" status for some reasons. mostly because of the less attention of the smallholders to practice good farming and processing and probably "more flexible" for the smallholders in running this type of business model.

The cocoa smallholders even may "choose" to sell their cocoa beans to the brokers who are mostly called *tengkulak* with the price determined by the *tengkulak* as a compensation for repaying the credit they received before from the *tengkulak*. Due to the relatively low in quality, *Resopammase* requires to further processes the cocoa beans from the cocoa smallholders especially drying (to reduces the moisture contents of the cocoa beans) and sortation. Slightly different from the first model, in the second model the cocoa smallholders sell by cash payment their dry cocoa beans they produce to the *poktan*, where they are the members. The *poktan* collects the cocoa beans and do further processing if required especially drying and sortation before delivering the dry cocoa beans to *Resopammase*. The third model is totally different from the two other models. At the same day after harvesting the cocoa pods collectively in their farms, the cocoa smallholders deliver soon their cocoa to the *poktan*, where they are the members, in the

form of wet-cocoa beans (paid by cash) for fermentation to take place. The *poktan* then do fermentation, drying, and sortation in the Cocoa Processing Center (CPC) or *Unit Pengolahan Hasil (UPH)* in a relatively big quantity. At this time, the number of poktan joining in the Resopammase's cocoa supply chain is 6 *poktan* in the first model, 3 *poktan* in the second model, and the rest 7 *poktan* in the third model of the total 16 *poktan*.

The finance to support the *poktan* activities comes from the revenue received in buying transaction of cocoa with the cocoa smallholders and in selling transaction of cocoa with the *Gapoktan Resopammase*, especially for the second and the third cocoa farming models. For the third cocoa farming model, for example, the sum of the price deduction imposed to the wet-cocoa beans in the buying transaction and the profit margin in the selling transaction is calculated as *poktan*'s profit.

The amount will be returned back to the cocoa smallholder as a profit sharing and the rest to the *poktan* for working capital accumulation, each 50 % of the amount. For the cocoa smallholders besides receiving cash payment for the wet-cocoa beans they deliver to the *poktan* in every transaction, they also will receive profit sharing as a characteristic of a cooperative institution. The price deduction imposed to the wet-cocoa beans is more and less equivalent to the predicted total processing costs to convert the wet cocoa beans to dry fermented cocoa beans. The cocoa smallholders who work part time in the CPC will also receive salary, according to their works.

Table 1. Definition of criteria and sub-criteria

No	Criteria and Sub-criteria	Definition
1.	Continuity of supply	The availability of the cocoa supply in quantity for a certain period
	• Plant conversion	Cocoa plant conversion to other plants
	• Application of GAP	A system covering the minimum requirements for on-farm; (plantation to pod harvesting)
	• Application of GMP	A system convering the minimum requirement for after-harvest; (processing of cocoa pods to cocoa beans)
	• Agro climate	A condition related to the climate, that may affect plantation, climate, rainfall, season, harvesting etc.
2.	Cocoa bean quality	Characteristics of the cocoa beans related to quality
	• Clone	A group of cocoa plants in one species, multiplied by vegetative means with different characteristics, but uniform, and stable. (eg. Clone GT-1, BPM-1, Sulawesi 1, etc.).
	• Application of GAP	See Continuity of supply
	• Application of GMP	See Continuity of supply
	• Agro climate	See Continuity of supply
3.	Responsiveness	The ability of the model to respond and handle any *Resopammase* complaint regarding to the quality of the cocoa beans produced.
4.	Cost efficiency	Efficiency in costs to produce cocoa beans
	• Production cost	Efficiency in production cost (on farm and after harvest)
	• Transportation cost	Efficiency in transportation cost to deliver the wet or dry beans to the *Resopammase's* destination
5.	Cocoa farming management	The ability of the model to define, organize and coordinate production factors (human resources, capital, and technology)
	• Human resources	Cocoa smallholders or *poktan* staff involving in the model
	• Capital	Capital or investment required to run cocoa farming (off-farm and after harvest)
	• Technology	Technology of cocoa plantation, farming and processing.

3.2 Criteria and Subcriteria

There are five criteria (with 13 sub-criterias) in all defined in this research to evaluate the performances of the three cocoa farming models. Those criteria respectively are continuity of the cocoa bean supply, cocoa bean quality, responsiveness, cost efficiency, and management of the cocoa farming. The only criteria which does not have sub-criteria is responsiveness criteria. Definition of each criteria and sub-criteria is given in Tabel 1.

3.3 The Priority Levels of the Criteria, Sub-criteria and Farming Models

The priority levels of the criteria with respect to the model performances are shown in Table 2, whereas of the sub-criteria with respect to the criteria are in Table 3.

Table 2. The priority levels of the criteria with respect to the model performances

Criteria	Priority level	CR
Continuity of supply	0,216	
Quality	0,343	
Responsiveness	0,099	0,0048
Cocoa farming management	0,194	
Cost efficiency	0,147	

As shown in Table 2, the first priority criteria in evaluating the model performance is cocoa bean quality (0.343), followed by continuity of the supply (0.216), cocoa farming management (0.194), cost efficiency (0.147), and finally responsiveness (0.099).

As stated before, the classical problem of the Indonesia's cocoa is the low in quality, especially those produced by the cocoa smallholders. As well known, the "automatic detention", a price penalty in London and New York terminals for most cases of the cocoa beans exported is caused by the low in quality (Rahmadi, 2009). Generally, cocoa from Indonesia has been used just for blending to attain certain flavors or just to squeeze the butter content. Study by Yunus and Yulismulianti (2010) showed the importance to place the cleaning and sortation step for the raw cocoa beans reception as a critical control point in the cocoa processing industry. This is to ensure that the cocoa beans are free or are in safe levels from molds, insects, wastes, and any infestation, and free from foreign matters. In fact, Kumala *et al.* (2014) in their research on analysis and risk mitigation of sustainable cocoa agroindustry supply chain found that two of the top three high risks in the cocoa supply chain are cocoa bean quality followed by supply. The analysis uses Fuzzy AHP. The factors, as sub-criteria that may affect the quality consist of application of Good Agriculture Practice or GAP for on-farm (0.525), aplplication of Good Manufacturing Practice or GMP for after harvest (0.312), agro-climate (0.107), and cocoa clones (0.056).

As stated before, to maintain production at an economic scale, the cocoa processing industry requires continuity in the supply of the cocoa beans. Similarly, for the firms, even *gapoktan* which do cocoa trading usually need the continuity of the supply to run their business at the economic scales. Moreover, while the world demand for cocoa is proyected to increase at 2-4 % a year (Faiz and Sumarna, 2013), there has been a tendency the Indonesia' cocoa bean production has decreased or stagnant (*Kemenperin*, 2013) and a tendency some cocoa

farmers converting their cocoa plant to other plants during the last few years (Sikumbang, 2013). The factors or sub-criteria that may affect the continuity of the supply are aplication of GAP (0.653) and GMP (0.140), agro climate (0.112), and cocoa plant conversion (0.096).

The abilty of the cocoa farming management to well define, orginize, and coordinate production factors under its control contributes to create good farming performances (*Kementan,* 2009). The factors or sub-criteria that may affect the cocoa farming management are human resources (0.633), processing technology (0.188), and capital (0.179). Saragih (2012) in his research dealing with the development strategy for the cocoa smallholders in Asahan Regency, South Sumatera Province of Indonesia concluded that the factors affecting the strategy by rank are human resources, marketing, and technology, respectively.

Cost efficiency in this *Resopammase* case study covers efficiencies in production cost and transportation cost, while responsiveness focuses only on response of the cocoa smallholders or the *poktan* to handle any complaint from *Resopammase* regarding quality of the cocoa beans they produce and deliver to *Resopammase*. The factors or sub-criteria that may affect the cost efficiency are efficiency in production cost (0.778), and efficiency in transportation cost, the total costs for delivering the cocoa beans from farms to *Resopammase'* s destination (0.222).

The slightly more important of the cocoa farming management criteria over the cost efficiency and responsiveness, may be explained that if the cocoa farming is well managed, the probability for the cocoa farming to improve the efficiency and responsiveness will also be higher. It is similar for the more important of the quality criteria over the responsiveness. If the cocoa farming is able to produce quality cocoa beans, then the probability to handle the complaint regarding quality properly and quickly will also be higher.

The importance of climate factors towards cocoa yields both quality and quantity have been studied broadly (Anshari, 2002 and Basri Zainuddin, 2010). The nature condition related to climate may effect seasons, rainfall, plantation, harvesting, etc. Studies conducted in Nigeria, Ghana, and Cote D'Ivoire showed that there is a long run equilibrium relationship between cocoa yield and rainfall with a different speed of adjustment to the equilibrium (Amos and Thompson, 2015, and Kenneth and Insah Baba, 2011).

Cocoa plant materials can be provided through two ways namely seedling and clonal. The latest has become important in cocoa farming due to its uniform cultivation and genetically vigor-performances against Helopeltis sp., CPB and VCD attacks (Wahyudi and Misnawi, 2008). Some of the cocoa clones recommeded include PBC-123, Sulawesi 03 and ICCRI-07 to improve quality of the cocoa beans produced by the smallholders. The priority level of the cocoa farming models with respect to the sub-criteria is shown in Table 4.

3.4 The overall priority level

In the end, the overall priority levels for each of the cocoa farming model is given

Table 3. The priority level of the sub-citeria with respect to the criteria

No.	Criteria and Sub-criteria	Priority Level	CR
1.	Quality		0,0200
	• Cocoa *clone*s	0,056	
	• GAP	0,525	
	• GMP	0,312	
	• Agro-climate	0,107	
2.	Supply continuity		0.0009
	• Cocoa plant conversion GAP	0.096	
	• GAP	0.653	
	• GMP	0,140	
	• Agro-climate	0,112	
3.	Cocoa farming management		0.0020
	• Human resources	0,633	
	• Capital	0,179	
	• Processing technology	0.188	
4.	Cost efficiency		0,0000
	• Production cost	0,778	
	• Transportation cost	0,222	

Table 4. The priority level of the cocoa farming models with respect to the sub-criteria

No	Criteria dan Sub-criteria	Priority Level			CR
		Cocoa Farming Model I	Cocoa Farming Model II	Cocoa Farming Model III	
1.	Supply continuity	0.153	0.205	0.642	0.001
	• Cocoa plant conversion	0,155	0.287	0.558	0.003
	• GAP	0.147	0.183	0.670	0.003
	• GMP	0.075	0.173	0.753	0.070
	• Agro-climate	0.288	0.300	0.412	0.002
2.	Quality	0,161	0.197	0.642	0.020
	• Cocoa *clone*s	0.163	0.252	0.584	0.001
	• GAP	0.202	0.206	0.592	0.004
	• GMP	0.089	0.142	0.769	0.007
	• Agro-climate	0.168	0.290	0.542	0.020
3.	Responsiveness	0.136	0.110	0.756	0.004
4.	Cocoa farming management	0.086	0.177	0.736	0.002
	• Human resources	0.096	0.147	0.757	0.010
	• Capital	0.064	0.232	0.704	0.040
	• Processing technology	0.074	0.228	0.698	0.050
5.	Cost efficiency	0.073	0.224	0.703	0.000
	• Production cost	0.074	0.214	0.709	0.020
	• Transportation cost	0.071	0.249	0.680	0.050

in Table 5. Each cocoa farming model has an overall priority level corresponding to its "fit" to all model performance judgments about the criteria. The CR < 0.10 in Table 2 to Table 5, indicating the consistency of all the criteria levels.

By ranks, the third cocoa farming model has the highest overall priority level (0.699), followed by the second model (0.196), and the first model (0.136), as also shown in its

priority levels againts all criteria and sub-criteria (Table 4). The third cocoa farming model lead the two other models in technical, resources, and institutional aspects.

Table 5. The overall priority level of cocoa the farming models.

Cocoa farming models	Priority level	CR
Cocoa Farming Model I	0,136	
Cocoa Farming Model II	0,196	0,010
Cocoa Farming Model III	0,699	

Different from the two other models, the first model is facilitated with a CPC, as mentioned before, and standard operation prosedures (SOPs) for both on-farm and after harvest. Those procedures cover the basic principal of GAP and GMP. Only the third and the second models, more specially the third model, apply the procedure consistently, while the first model does not, indicated by the cocoa bean resulted in by the first model relatively low in quality.

As stressed by Sri Mulato (2013), the CPCs in *poktan* have very important roles for producing dry cocoa beans which comply with the SNI 2323:2008 standards, and even to increase productivity levels. According to Sri Mulato (2013), the CPCs integrate technology, infrastructures, human resources, and transformation of the attitude from "traditional business" to "industrial business". Subekti (2010), who investigated the low in productivity level of the cocoa farming in one village of District of East Sentani, Regency of Jayapura, Papua Province of Indonesia concluded that the main factors affecting on that low productivity are the plantation area, capital, and working intensity, as well as the frequency of the cocoa smallholders attending trainings related to cocoa plantation and processing. The decline in the cocoa production in Nigeria since the 1980's, as stated by Osas *et al*., (2010) is also due to non adoption of improved farming practices besides insect, pest, and diseases.

For the cocoa smallholders in the third and the second models, again more specially in the third model, the existence of *poktan* is considered very beneficial. The function of the *poktan* is not only as a "place" to discuss and decide the schedules for farm cleaning (plant bug and diseases prevention) and cocoa harvesting and to take trainings, but also as a business cooperative institution.

The latest is to improve the bargaining position of the cocoa smallholders in marketing aspect. As stated by Kumala *et al*. (2014), the strategy to improve the selling price of cocoa beans is by strengthening institutional, and application of GAP, and GMP consistently. In strengthening institutional of the cocoa smallholders is educating smallholders to have good technical skill and marketing aspect as well in a parallel linkage (Arsyad *et al*., 2014).

To improve the quality of the cocoa beans, Syadullah (2012) recommends that the government revenue from the cocoa bean export duty is returned back to cocoa farmers (including the cocoa farmers involve in the first and the second cocoa farming models in this research) in the form of improved and adequate infrastuctures (CPCs) in the cocoa production centers as well as provision of higher quality seeds and better counseling.

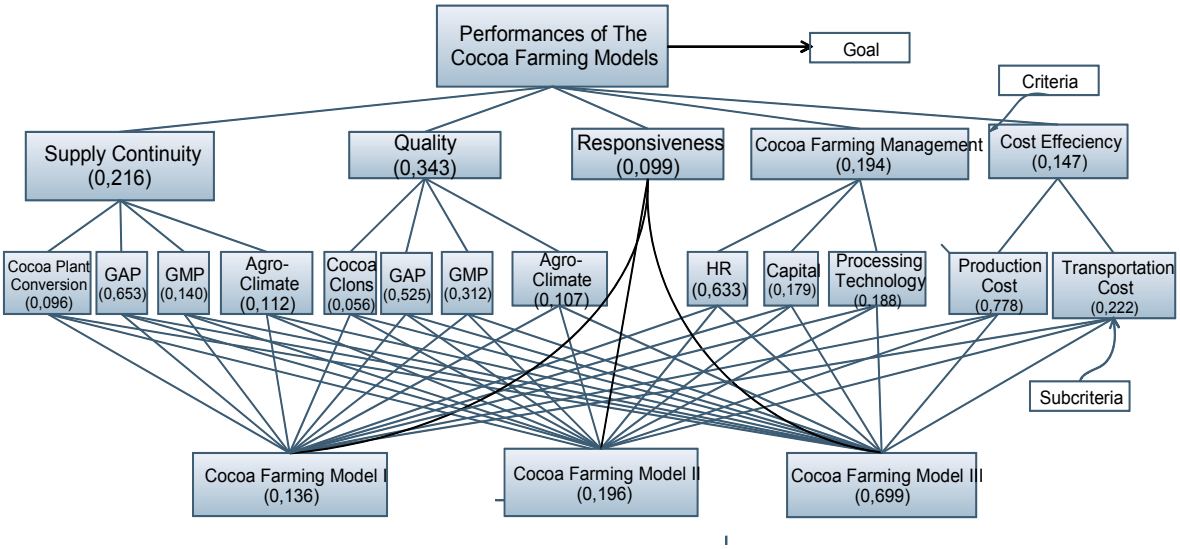

Figure 1. The hierarchical structure of the farming model performance problem

Compared to the first cocoa farming model, the second model is more potentially to be converted to the third model, if the second model is facilitated with CPSs.

4. Conclusion

Of the three cocoa farming models in the case of *Resopammas's* cocoa bean supply chain, the third model where the cocoa smallholder deliver their cocoa in the form of wet-cocoa beans to the *poktan* for further processing (i.e. fermentation, drying, and sortation) to produce dry fermented cocoa beans has the highest overall priority level in performances, compared to other two. Criteria to evaluate the performances cover continuity of the cocoa bean supply, cocoa bean quality, responsiveness, cost efficiency, and cocoa farming management. The model is suggested to be duplicated or developed in every *poktan* and *gapoktan* (including in other cocoa production centers) in order to improve cocoa quality according to the standard requirements, supply continuity, and bargaining position of the cocoa smallholders in marketing aspect as well. For policy makers, this finding can be used as one of the references for the Indonesia's cocoa farming development in order to improve quality and increase production of the cocoa beans of the cocoa smallholders parallel to the increase in the cocoa farmer's income.

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