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Selection of Beef Production Systems in Bali: An Analytical Network with BOCR Approach

Gede Nyoman Wiratanaya[1*] Dwi Putra Darmawan[2] Lala M. Kolopaking[3] Wayan Windia[2]
1. Doctoral Study Program of Agricultural Science, Udayana University, Bali, Indonesia
2. Faculty of Agriculture, Udayana University, Bali, Indonesia
3. Faculty of Human Ecology, Bogor Agricultural University, Bogor, Indonesia
*E-mail of the corresponding author: yayak.wiratanaya@yahoo.com

Abstract
A model of Analytical Network with BOCR (Benefits, Opportunities, Costs and Risks) successfully applied in Bali to choose the best system of commodity beef production in 2014. This model has a complete multi-layer structure as follows: (a) Top-level network with the ratings spreadsheet to evaluate BOCR having regard to the strategic criteria (food accessibility, availability and distribution of food, and facilities), (b) control criteria for networks in BOCR elements, and (c) Decision networks for each critical control criteria. The results showed that the frozen beef production system is the best alternative with the relative priority of 47.69%. The priority value is a result which has been comprehensively considering the merit of BOCR. Sensitivity analysis of selected production system shows that if a priority, both at the level of BOCR elements and the level of control criteria changed, frozen beef production system remains dominant and does not change the ranking of the overall production system selection, unless used assumptions that extreme changes in BOCR priority. The business model that is suitable be realized in cattle production centers in rural area of Bali is a model of community-based value chain for frozen beef involving the "BUMDes" (village-owned social enterprises) and the "BUM antar Desa" (inter-village BUM).
Keywords: selection of production systems, ANP with BOCR approach, community-based value chain of frozen beef in Bali.

1. Introduction

Various policies, strategies, and agricultural and rural development programs in the form of conservation activities in the carrying capacity of local resources seize the opportunities that exist, both at local and national level is a smart alternative solution. Nowadays, the development of the regional economy is not running as expected. Lack of support of cooperation and connectivity among strategies considered as the main cause of managerial and give the impression that the performance is not optimal. Therefore, it takes planning and budgeting reforms framed and reorientation toward the medium-term economic development of the region based on analysis of strategic issues, as well as operational measures in the form of a more structured system engineering (Forrester, 1968; Kaplan and Norton, 2004), of course, in order to encourage the expansion of commodity production beyond the limits of subsistence beef cattle farm in Bali and other provinces in cattle production centers in Indonesia (Purba and Hadi, 2012). This can be interpreted as an effort to optimize the use of resources commodity of beef in a national economic development.

Bali cattle as the main cattle germplasm in Indonesia has a competitive advantage compared to other types of cattle (egg Madura cattle and Ongole) because of the ability to live in a state of nature and the environment Indonesia and bring substantial benefits to producers and consumers in Indonesia. Suparta (2014) stated that Bali cattle farms dominate the eastern part of Indonesia (South Sulawesi, NTB, and NTT) with a total population of 4.8 million heads (34.31%) so that the Directorate General of Livestock at the Ministry of Agriculture set Bali cattle as a strategic commodity in framework of national self-sufficiency in beef.

Theoretically, the demand for food is limited by population, income, tastes, and the relative output prices (Pearson et al., 2004). Demand for beef is strong demand. In the last five years occurred trend of increasing population, GDP per capita, and CPI (Purba, 2012). The Ministry of Agriculture has projected demand for beef reached 549.7 thousand tons and even UGM in cooperation with Apfindo do predict reached 640 thousand tons in 2014. This is a great opportunity for the development of cattle Bali in Indonesia.

Aside from being national germplasm beef cattle, cattle Bali has a good production quality with the taste and texture of meat that is typical. Purba (2012) research finding showed that the Indonesian people like to consume food made from beef, such as meatballs, shredded meat, "rendang", and "soto". Market prospects are good if not matched with adequate cattle population in turn will increase the dependence on imported meat supply. Over the past five years, the trend of imports of beef, live cattle, and offal increased sharply.

Cattle population decline gradually as a result of cutting a massive cattle, including cows, occur every year. The phenomenon of degradation of the genetic quality of cattle revealed by Kusuma (2010) that the availability of low supply of cattle suspected by the presence of the body decreases, decreased carcass percentage (maximum 56%) and high mortality due to low intake of mother's milk. Cow weights above 300 kg is

very limited, so if it is associated with an increase in market demand, the tonnage needs to be covered by increasing the number of cows that have to be cut. The implications of this degradation are the cutting bulls are good and productive cows, and cows leaving a collection of poor quality. Finally, Bali cattle population has born genetically inferior and degraded. BPS data (2014) revealed that the increase in imports of meat has reached 90,000 tons with a cheaper price than the price of domestic beef, so obviously reduce the competitiveness of domestic products and in turn lowers the livelihoods of farmers.

Observing the enormous potential market demand of beef on one side, and constraints availability and distribution of beef due to limited resources, production and processing technology, relative input prices, management, support facilities, and the dependence of imported beef on the other side, needs fundamental policy improvements which refers to the solution of the problem with the approach of the comprehensive system. Therefore, the concept of agro-industry development of beef cattle is not only oriented to the production or the fulfillment of national food needs, but should be able to improve the quality of life of farmers. Another consideration is that beef is a food product that is easily damaged, so it takes more supervision through inspection and testing in order to set a prevention policy residues and microbial contamination in animal products (Purba, 2012; Purba and Hadi, 2012).

Indeed, the issue of self-sufficiency in meat compliance is a complex multidimensional problem, ranging from the production process in both upstream and downstream. The phenomenon of dependence of national beef have influenced by the dynamics relationship of supply, demand, and price of the world (Pearson et al., 2004; Darmawan, 2011a). Domestic production and supply of imported beef is not able to meet national needs for the period 2010-2012, primarily due to an increase in consumption and import quotas, resulting in instability of the national beef prices. It is seen from the volatility of the price of each month that fluctuates between 1.78% in August-September 2013, up to 4.47% in the month of June-July 2011 during the period 2011-2014. The existence of a repeating pattern indicates an increase in prices during the holy month of Ramadan and Idul Fitri during the period 2011- 2013, to an average price rise of 3.2%. Since the existence of an import quota restrictions from June 2012, the average price rose 10.3% to USD 76 925, - / kg. Then the average price in 2013 increased 17.5% to Rp 90 402 / kg and the average price rose 9.7% in 2014 to Rp 99 173 / kg. Transportation costs are too expensive so when up in Jakarta or other big cities affect the price will be expensive. Indeed Indonesia could be self-sufficient in meat as long as it is accompanied also by a reliable marine transportation system (Windia, 2014).The fluctuations in domenstic price of beef due to the length of the supply chain and transportation of live cattle from farmers to consumers (Purba, 2012). In a way, the cattle are often impaired animal welfare (animal welfare), such as: broken, shock, died on the way, the weight of the body shrink drastically. That risk resulting falls in the price of beef at the consumer level.

So far, the problem commodity beef trade system consists of the following two aspects: (1) production aspects, i.e. (a) the discovery of Slaughter House (RPH) in Indonesia, which does not work in increasing the value added (value-added) and is oriented as producer of fresh meat (hot carcass) to meet the needs of traditional markets only. This is due to the way the community views erroneously that fresh meat is healthier and quality compared to meat processed through the cold chain. Though beef is a commodity that is very fast decay; (b) lack of oversight and government protection for public health and inner peace consumers of meat in question the status of safe, healthy, intact and halal ("ASUH" meat). This was due to the abattoir does not meet the criteria of hygiene and sanitation expected, the widespread cuts in the houses are traditionally (TPH), the absence of veterinary public health services (Veterinary Public Health) ante mortem and postmortem examination as in the process of cutting at RPH, so health production is doubtful; (c) the persistence of the charges / levies that are not matched by the quality of service / inspection work is worth and not appropriate oversight mechanisms Veterinary Public Health; (2) Distribution aspect, i.e. almost all of the abattoir (slaughterhouse) in the district / city does not have a strong marketing network in the distribution process due to the unavailability of equipment for the integrated cold chain, lack of refrigerated transport equipment, blast freezer and cold storage in port or in the wholesale market. In addition, the culture that prefers to consume fresh meat is still difficult to change.

Strategy required by the government at least should have an impact on people's livestock system is the backbone of production in the country and the business must be profitable farming communities that are guarantee of sustainability. Meat processing industry as a locomotive production should be promoted well in order to select a particular commodity production system (Chen et al., 2008; Flala and Jablonsky, 2001). This problem requires a new approach to the solution, at least referring to improvement of production processes and business administration of live cattle and beef. Realization improvement of means of support for the production of local beef should be done, among others, by implementing revitalization Slaughter House (RPH) as an institution beef processing, in addition to cutting services and logistics business.

Referring to the big picture problems, the demands on originality, become very essential and urgent to design study based on analytic network process systems to help identify and set priorities on the basis of the experience and knowledge of the decision makers for the design of the system allows a decision can be made on the basis of simultaneous interaction into an arrangement of functional elements of the expansion of the domestic

beef market. The theoretical framework to help organize logical or intuitive considerations in making a complex chart to a simple and logical way, instead of making it simple to more complex (Karsak et al., 2003; Nakagawa and Sekitani, 2004; Saaty and Vargas, 2006).

Based on description above, this study aims to: (a) selecting the best beef production system stable in Bali which has considered merit BOCR, (b) examine the stability of the best production system chosen, both on the level and level controls BOCR essential criteria, and (c) propose a preliminary draft a business model for a community based value chain of beef involving the institutions of social enterprises in the production centers in rural Bali.

2. Methodology

Model selection of beef production systems in Bali has a complete multi-layer structure with nodes of BOCR (Benefits, Opportunities, Costs, and Risks) at the top-level Networks, control criteria within the subnet, and subnet decision (Decision Networks) containing the alternatives associated with the influence of subcriteria control on goal. Decision networks created for each essential element of the control criteria. Top-level model also has a ratings component to evaluate the intensity and merit of BOCR (Saaty, 2003; Saaty, 2001; Saaty, 2005; Saaty and Vargas, 2006). The main reason why the ANP with of BOCR is chosen as the decision analysis tool is that this model accommodates the relationship of interdependence between elements of a system of beef production. The database is drawn from research conducted in the province of Bali in 2014.

The expert meeting decision makers in the selection of commodity beef production systems based on community in Bali is a member of parliament and local government (provincial, district / city), as well as business people in other provinces (the buyers and the sellers of the main market in the production center cattle feedlots and smallholder cattle production centers), as well as food experts and food industrialists. Information or data obtained through pairwise comparison process systematically to include all combinations of elements or clusters relationship. ANP using basic comparison scale (1-9) are the same as the AHP (Saaty and Vargas, 2006). Comparison Scale allows decision makers combining experience and knowledge is intuitive (Saaty and Vargas, 2006) and shows the number of times an element dominates the other elements with attention to certain criteria. The decision makers (elected sources) express a preference on each pair of verbal elements, i.e.: equally important, moderately more important, more important strongly, very strongly more important, and extremely more important. Descriptive preference is then translated into numbers: 1,3,5,7, and 9. Numbers 2, 4, 6, and 8 is an intermediate value between two successive qualitative assessments. The opposite value (reciprocals) is used if the order of the elements reversed dominance.

Alternative systems of beef production are as follows: (1) frozen beef production systems, (2) fresh beef production systems (hot carcass), and (3) live cattle production system.

ANP models with BOCR developed using software Super Decisions have the following structure of decisions (Saaty, 2003; Saaty and Vargas, 2006).

a. Top-level Network is a single network with a hierarchical structure that has elements BOCR and strategic criteria (with related sub-criteria) to evaluate the importance of this decision. This network has ratings spreadsheet that is used to evaluate BOCR with attention to the strategic criteria.
b. Control Criteria Networks. Each BOCR has a subnet that contains the control criteria (and possibly subcriteria control). The structure in this subnet is hierarchical.
c. Decision Networks. Subnet decision in this study was made for each essential control subcriteria. Decision alternatives appear in a cluster on each subnet decision.

3. Results and Discussion

3.1 Top-Level Network

The Top-level Network is a single network that has the elements (nodes) of BOCR and strategic criteria are used to evaluate the importance of this decision. This network has ratings spreadsheet that is used to evaluate BOCR selected by taking into account the strategic criteria.

3.1.1 Top-level network model of beef production systems

Selection decisions of beef production system is reviewed in the context of the three strategic criteria of used to evaluate the merit (appropriateness) of BOCR, namely: food accessibility, availability and distribution of food, as well as support facilities. Food accessibility strategic criteria consists of two sub-criteria: market expansion and product purchasing power, while the strategic criteria of availability and distribution of food, cover subcriteria quality improvement products and product store capability. Last strategic criteria are supporting facilities, consisting of three sub-criteria of, namely the implementation time, capital to build the infrastructure, and revitalization of food technology. The criteria and sub-criteria are used to determine strategic priorities BOCR merit is shown in Figure 1. The elements in the cluster strategic criteria of compared in pairs with attention to the goal, which is assesses the merit BOCR strategic criteria selected.

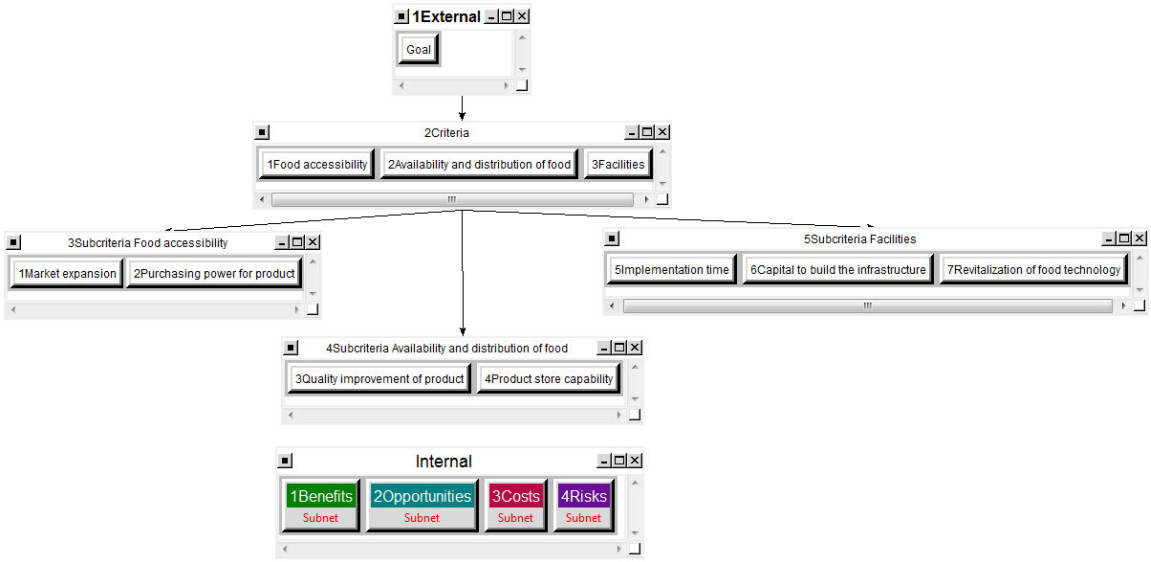

Figure 1. Top-Level Network Model of Beef Commodity Production Systems

3.1.2 Formula on the top-level network model of commodity beef production systems

In Top-level Network, there is a formula that combines the results of the subnet on the elements of BOCR. The formula used in this study is negative additive formula. Formula additives on the top-level networks in the Super Decisions seems complicated in fact merely to indicate that the value for BOCR as defined in the ratings used for weighting the alternative value of the subnet on elements BOCR.

3.1.3 Determining priorities BOCR Rating approach to the top-level network model of beef production systems

Priority of merits BOCR assessed using Approach Rating of ANP (based on five ranks, which is: very high, high, medium, low, and very low) and the results are summarized in Figure 2. This priority is used in the Top-level structure of the Network for the synthesis of overall priorities alternative of beef production systems. Market expansion, product purchasing power, improved product quality, product shelf life, the time of implementation, the capital to build the infrastructure, and the revitalization of food technology are seven main criteria necessary when making the decision to choose the system of production of live cattle and of beef are the best.

Priority of rating for merits BOCR calculated by multiplying the weight with the intensity of strategic sub-criteria rating on row BOCR, then add them to the priority of BOCR (Figure 2, on Priority column). For example, the (market expansion, Benefits) cell in Figure 2 was rated very high. Thus, the value for this cell is generated by multiplying the value of very high (1.000) with weighting criteria of Market expansion (0.483). Priority of BOCR merit obtained from the accumulated value of the seven strategic subcriteria. Further, the value obtained normalized to produce figures priority.

From Figure 2 on row of Benefits, for example, revealed that the choice of the best beef production system providing excellence in expanding market (with a very high rank), increase purchasing power (high), improving product quality (very high) and the shelf (very high), although it has a disadvantage in terms of the implementation of a long time (low rank), the need for large capital to build infrastructure (very low), and revitalize the food technology (medium).

	Priorities	Totals	1Market expansion 0.482645	2Purchasing power for product 0.321763	3Quality improvement of product 0.081608	4Product store capability 0.040202	5Implementation time 0.012058	6Capital to build the infrastructure 0.039814	7Revitalization of food technology 0.021910
1Benefits	0.466273	0.820538	Very High	High	Very High	Very High	Low	Very Low	Medium
2Opportunities	0.305944	0.538393	High	Medium	Very High	High	Very Low	Very Low	Very Low
3Costs	0.131950	0.232204	Very Low	Low	Very Low	Very Low	High	Very High	Very High
4Risks	0.095833	0.168644	Very Low	Very Low	Very Low	Very Low	High	Medium	High

Figure 2. Ratings Spreadsheet and BOCR priority at the top-level network model of commodity beef production systems

Based on the results confirm that the selected experts as resource persons, it can be concluded that in choosing Bali beef production systems, priority control criteria are the nodes of Benefit as the main element of the evaluation with the highest priority of 0.466, followed successively by the elements of Opportunities (0.306), costs (0.132), and Risks (0.096).

3.2 Control Criteria Networks

Each element has a subnet merit BOCR control criteria. Benefits subnets shown in Figure 4, while for the subnet OCR is presented in Appendix 1-3. Control criteria and sub-criteria for each control BOCR summarized in Table 1. From Table 1 obtained information that there are 29 sub-criteria in BOCR control and priorities (local priorities) through pairwise comparison (opinion of stakeholders' production system is used as input to the software table Questionnaire Mode Super Decisions). It has been known previously that merit priority BOCR (Table 1 column 1) is obtained by Ratings Model. Especially for global priority (global priorities), its value is calculated with Excel. For example, the numbers 0.024 on the economic resilience of society subcriteria obtained by multiplying 0.466 x 0.375 x 0.136.

In subnet Benefits, three main control criteria, namely: control criteria Economic, Social, and Technological compared in pairs with regard goal (Goal: 1Benefits Control Criteria Hierarchy). Furthermore, the economic resilience subcriteria community of Bali, toughness beef agro-industry, product price, capacity and speed of production, electric operator and product lines variations that are safe, healthy, intact, and Halal ("ASUH"), compared in pairs with respect to control criteria Economics, and so on.

In the next stage, the principle economize effort (applying the Pareto principle) would be very useful in managing the strategic plan (Darmawan, 2013) in order to establish which aspects should be the focus of the study. In this study, 10 of the 29 sub-criteria control generates majority of outcomes (i.e. 75% of the total global priorities, according the rule of thumb of Saaty, 2003). Tenth meaningful sub-criteria are: Toughness agroindustrial beef, Tranquility consuming, RPH technological advances, sales of "ASUH" products, development of new business (corporate split off sections), the initial Costs, Needs specific business model, Institutional farmers, business competition, and production failure. Furthermore, Decision Networks made to control the 10 sub-criteria. The priority then renormalized accordance with BOCR.

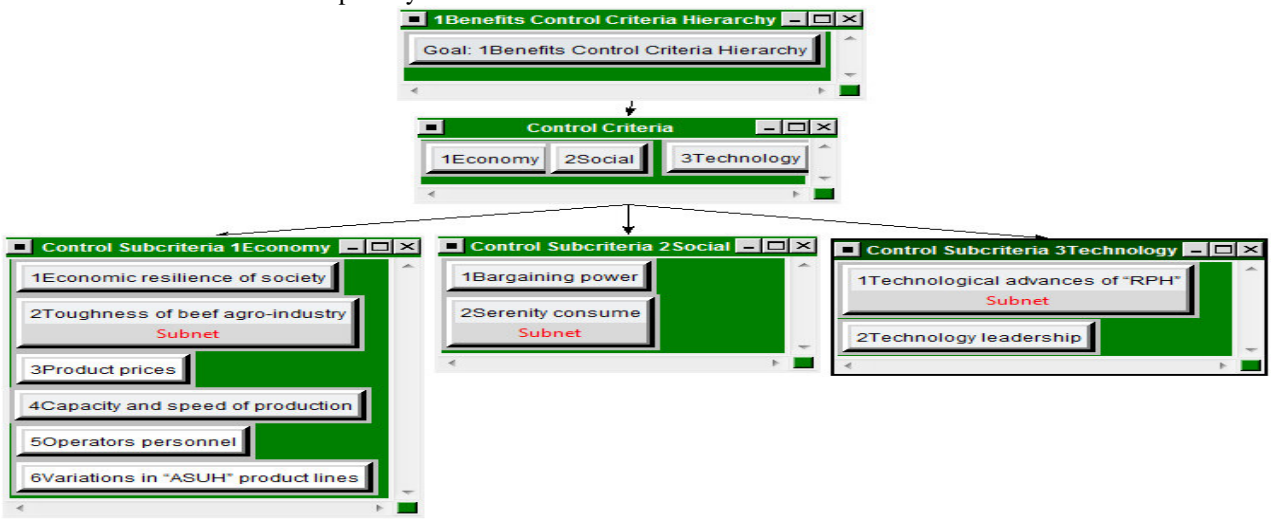

Figure 3. Criteria Controls on Subnet Benefits

Table 1. Merit BOCR, Criteria and Subcriteria Control, and the Priorities

Merit		Criteria		Subcriteria	Local Priorities	Global Priorities
(1)		(2)		(3)	(4)	(5)
Benefits	0.466	1Economy	0.375	1Economic resilience of society	0.136	0.024
				2Toughness of beef agro-industry	0.541	[a]**0.095**
				3Product prices	0.122	0.021
				4Capacity and speed of production	0.094	0.016
				5Operators personnel	0.064	0.011
				6Variations in “ASUH” product lines	0.044	0.008
		2Social	0.219	1Bargaining power	0.111	0.011
				2Serenity consume	0.889	**0.091**
		3Technology	0.406	1Technological advances of “RPH”	0.900	**0.170**
				2Technology leadership	0.100	0.019
Opportunities	0.306			1Competence to produce	0.056	0.017
				2Competence in marketing function	0.047	0.014
				3”ASUH” product sales	0.656	**0.201**
				4Development of new business	0.241	**0.074**
Costs	0.132	1Economy	0.75	1Manpower needs	0.113	0.011
				2Initial costs	0.327	**0.032**
				3Lead time of implementation	0.071	0.007
				4Needs of place to operate	0.123	0.012
				5Centralized control system	0.094	0.009
				6Needs for specific business model	0.272	**0.027**
		2Social	0.25	1Shifting of consumer preferences	0.200	0.007
				2Farmers institution	0.800	**0.026**
Risks	0.096			1Commitment of top management	0.082	0.008
				2Business competition	0.263	**0.025**
				3Involvement of employees	0.086	0.008
				4Training needs of employees	0.074	0.007
				5 Raw material requirements	0.056	0.005
				6 Stability of business environment	0.160	0.015
				7Failure production	0.278	**0.027**

3.3 Decision Networks

Decision Networks on subnet Toughness beef agro-industry in the Benefits of Economic control criteria is presented in Figure 5.

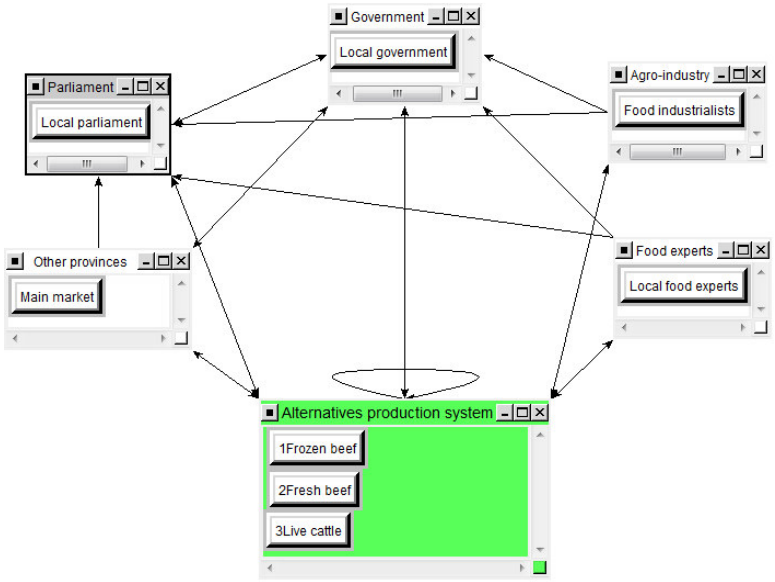

Figure 4. Decision Networks in subnet Toughness of beef agro-industry for Economic control criteria on Benefits

In Figure 5, it is appears that the key decision-makers are Parliament and local government (provincial and district/city), as well as business players from other provinces who became a major commodity market of live cattle and beef outside of Bali. Experts in the field of food and food industrialists affect the executive and legislative linked through the provision of technical information and their professional expertise, while the buyers of cattle and beef (mainly in Jakarta and South Sulawesi) provide information and coordination in terms of the quantity needs of cattle and beef and market price. Parliament and local government, industrialist food, and food experts expressed their opinions about the third alternative production systems in the context of improving toughness beef agro-industry. The analysis showed that the frozen beef production system was ranked first in terms of increasing the toughness of the agro-industry beef, followed successively by fresh meat production system and live cattle production system. In the Alternatives cluster are inner dependence in terms of raw material use of live cattle to produce fresh meat and frozen meat. The same ranking pattern shown by the third alternative production systems to improve the subcriteria of serenity consume, RPH technological advances, product sales of "ASUH", new business development, initial cost, need for specific business models, institution of farmers, business competition, as well as production failure. Decision Networks for 9 subcriteria other important controls are presented in Appendix 4-13.

3.4 Overall Results

Final syntheses of various alternatives by using the formula for each node BOCR additives are shown in Table 2. The results of this study revealed that the implementation of frozen beef production systems demonstrate excellence and the highest expectations, though still a bit limited and resistance encountered. Overall results ensure that the system of commodity production of frozen beef is the best choice with the relative priority of 47.69% (Table 2 column 6). The priority value is a result which has been comprehensively considering merit BOCR. The next step is testing the stability of these results with what-if analysis techniques.

Tabel 2. Overall Results

Alternatives	Benefits (0.466)	Opportunities (0.306)	Cost (0.132)	Risks (0.096)	Overall
(1)	(2)	(3)	(4)[a]	(5)[b]	(6)
1Daging sapi beku	0.5667	0.6583	0.1167	0.117	0.4769
2Daging sapi segar	0.2566	0.2209	0.3935	0.319	0.2745
3Sapi hidup	0.1768	0.1209	0.4898	0.564	0.2487

[a]1/Costs normalized.
[b]1/Risks normalized.

3.5 Sensitivity Analysis

The sensitivity analysis was performed to ensure the stability of the results of the analytical network models have

been considering merit BOCR which has a multi-layered structure of this. This section will be observed the results of the sensitivity analysis using an additive formula in the Top-level Network. The sensitivity analysis shows that when one of the priorities of BOCR and critical control criteria are used as the independent variable (the variable increased or decreased weight, while others remain proportionally), the best alternative remains stable. In this study, the sensitivity analysis performed, both at the level BOCR and control criteria with the following results.

3.5.1 Sensitivity analysis at the level of BOCR

Although the value BOCR shifted along the line of experiments on Super Decisions, the system of commodity production of frozen beef remains dominant and does not change the overall rankings (Figure 4), unless used assumptions that extreme changes in BOCR priority. If priority Benefits reduced to below 0.105 (from the original priority for 0.466) and priority Opportunities also lowered under 0.026 (from the original priority 0.306), the live cattle production systems become the preferred alternative (ranked second). If priority Costs increased to 0.268 (from the original priority for 0.132), the live cattle production system gradually turns into the second option and eventually become the best alternative (Figure 6). The same thing happens if the priority Risks continue to be raised to 0.263 (from the original priority 0.096).

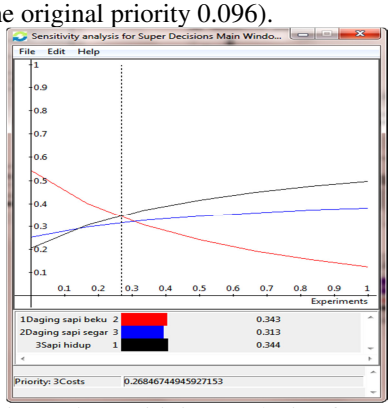

Figure 5. Sensitivity Analysis of Costs

3.5.2 Sensitivity analysis at the level of important control subcriteria

Stability tests performed for 10 important control subcriteria that has a decision network (Toughness agroindustrial beef, Tranquility consuming, RPH technological advances, product sales of "ASUH", new business development, initial costs, need for specific business models, Institution of farmers, business competition, and Failure production) shows that the outcome is very stable and does not change the overall alternative rankings. For example, if the priority need for specific business models continue to be raised to 0.907 (from the original global priorities for 0.027), cold beef production system remains the best option (Figure 7).

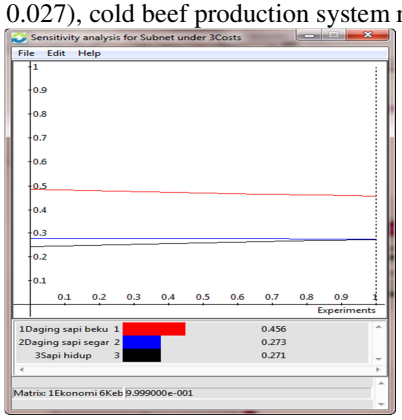

Figure 6. Sensitivity Analysis for Specific Business Models Needs

3.6 The perspective of Business Model for Community-Based Value Chain of Beef Involving Institute of Social Enterprises in Rural Areas

Based on ANP with BOCR analysis (Table 1), there are 10 major sub-criteria that are considered significant by the weight of each as follows: Toughness beef agro-industry (0.095), Serenity of people consume beef (0.091), Technological advancements of RPH (0:17), sales of "ASUH" products (0.201), Development of new business (0.074), initial cost (0.032), needs for specific business models (0.027), Institution of farmers (0.026), business Competition (0.025), and production failure (0.027). The ten sub-criteria are assumed control important and can be interpreted that the chosen alternative system (frozen beef production system) contributes over 75% in the achievement of objectives through its influence on the sub-criteria in the mechanism of the functional

relationship of cause and effect between elements, both inter and inter-cluster identified.

Originality of the model and the limitations of previous studies are largely determined by the experience of researchers and also depend on the knowledge and skills of speakers in an opinion, so it still needed further research and study in its implementation.

Deploying the system of production and distribution of frozen beef in Bali requires a multi-sectoral synergies. Governments need to develop policies that accommodate connectivity Bali as a hub, a place of transit of frozen beef products, before it is distributed to all major markets of frozen beef in Indonesia. Its implications, all stakeholders (including local government of Bali, Parliament, Industrialists and food experts from universities, as well as a major buyer of frozen beef in Jakarta) not only need to focus and participate actively in the development of agricultural and rural resource-based economy to increase food accessibility, availability and food distribution, food utilization, and supporting facilities (Darmawan, 2011b), but it also needs to be a symphony to be able to see the whole perspective, establishing connectivity across sectoral boundaries and regions, and combine the separate parts into a unified whole in order establish self-sufficiency and improve the resilience of the Balinese economy (Darmawan, 2014).

Therefore, in synthesizing a comprehensive strategic planning can be done by constructing a chart of the overall design based on the main criteria (Karsak et al., 2003; Yurdakul, 2003). This can be explained as a logical consideration of competent resource persons that frozen beef production systems contribute positively to build toughness of agro-industry beef, through technological advances of RPH so as to provide a product that is "ASUH" (safe, healthy, intact, and Halal) and in turn provide social benefits in the form of serenity for people to consume. The realization of such benefits is not apart from opportunities or new business development opportunities (such as supplier quality commodity markets under one roof, inspection, information products with integrated database, chamber cooling, the auction market with transparent transactions on-line, distribution and transport , payment, bank, and commodity warehouse receipts for frozen meat, the wholesale market of food and beverage products complete with a system of one-stop shopping and booking via the web store). This becomes very important as a precaution against changes in people's preferences towards more hygiene food (Purba, 2010).

Although the order of implementation will influence on need for initial costs in developing a specific business model, which is a comprehensive value chain that is more aligned to the group of farmers through the strengthening of the social enterprise in the production centers in rural areas (M4P, 2012; Thakkar et al. 2005), in the form of “BUMDes” (village owned social enterprises) and “BUM antar Desa” (inter-village owned social enterprises) (Kolopaking et al, 2014). In addition to these elements, frozen beef production system is not only beneficial to build a more effective value chain but also intuitively also will give a positive effect in today's competitive business, including its role in minimizing the cost of product quality failure.

4. Conclusion and Recommendations

4.1 Conclusions

1. Frozen beef production system is the best alternative with relative priority of 47.69% compared to the fresh meat production system (27.4%) and live cattle production systems (24.8%). The priority value is a result which has been comprehensively considering the merit BOCR.
2. The sensitivity analysis of the selected system shows that if the priority level or the level of sub-criteria BOCR important control to change, choice of frozen beef production system remains dominant and does not change the ranking of the overall production system choice, unless a change of priorities in the extreme assumptions on BOCR.
3. The business model that is suitable be realized in cattle production centers in rural area of Bali is a model of community-based value chain for frozen beef involving the "BUMDes" (village-owned social enterprises) and the "BUM antar Desa" (inter-village BUM).

4.2 Recommendations

1. Deploying frozen beef production systems in Bali requires a multi-sectoral synergies. The government needs to create a policy that puts Bali connectivity as a hub, a place of transit of frozen beef products, before it is distributed to all main market frozen beef in Indonesia. In addition, beef self-sufficiency policy should refer to the main criteria that influence the production and distribution systems of beef in Bali, such as agro-industry of beef toughness, serenity consume, slaughterhouse (RPH) technological advances, selling quality products of "ASUH", new business development, initial cost, specific needs of business models, farmers institution, business competition, and production failures. Beef self-sufficiency policy direction needs to be changed from regulation, governance and control of importation, import dependence of beef (from Australia or New Zealand) and live cattle (from Australia) towards local cattle farmers protection policies, both in production with feedlots and smallholder systems, which involving all stakeholders in order to achieve self sufficiency of beef and in turn strengthen food sovereignty, nation competitiveness, and national security.
2. To ensure effectiveness of frozen beef production system, required the following steps: (a) the revitalization

of slaughterhouse function as supporting the establishment of cold chain (cold chain) from slaughterhouse to the consumer, (b) strengthening efforts BUMDes and BUM inter-village in the field of local cattle farm and marketing (c) optimizing the role of district / city government and parliament in the frozen beef production systems, (d) provision of support facilities and rehabilitation of frozen beef production systems, including the effectiveness of the transport system for the smooth distribution of cattle and of beef between areas, and (e) increasing surveillance system of inter-area quarantine.

3. It is recommended to design a comprehensive business model of community-based value chain for commodities frozen beef from producers to consumers and in turn the development of a Food Park Bali. Value chain starting from cattle produced by farmers and collected at BUMNDes and BUM of inter-village in Bali cattle production centers. The center of the value chain is an organized market that serves as a marketing and logistics center, a combination of auction market (on-line transactions, space cooling, payment, and banks) and wholesale market (food and beverage products complete, one-stop shopping, ordering web store), as well as the placement of the supplier on the commodity market under one roof. Furthermore, commodities supplied to the purchaser, namely: supermarkets, retail, hotel, restaurant, and catering. Finally, it is useful to draw up a roadmap to realize the commodity value chain business model of frozen beef is community based.

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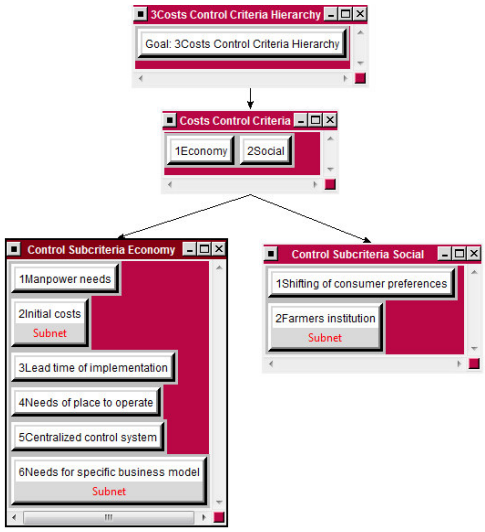
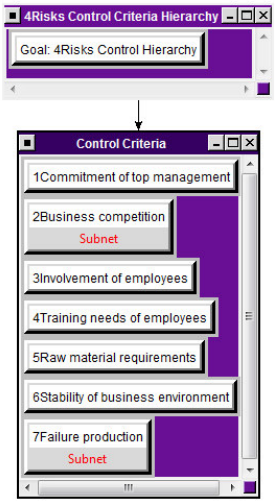
Appendices

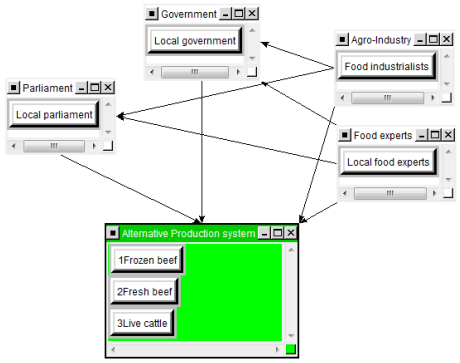
Appendix Figure 1. Opportunities Control Criteria Hierarchy



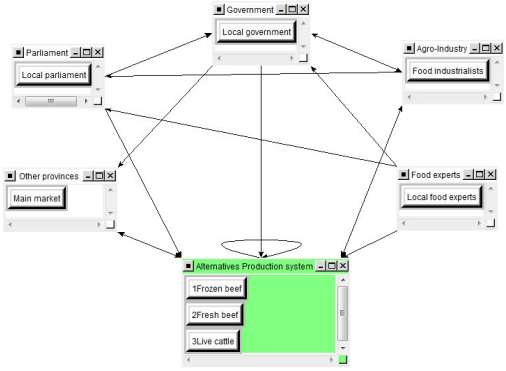
Appendix Figure 2. Costs Control Criteria Hierarchy



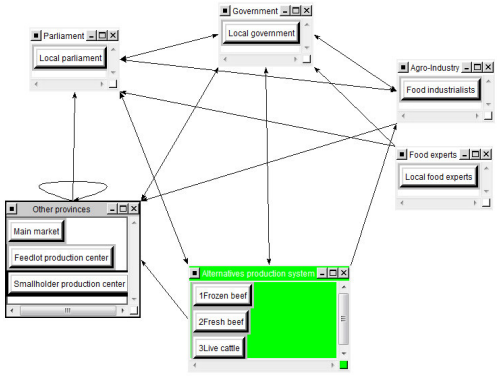
Appendix Figure 3. Risks Control Criteria Hierarchy



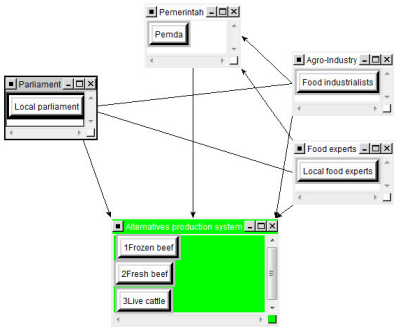
Appendix Figure 4. Decision Networks in Serenity Consume Subnet for Social Control Criteria On Benefits



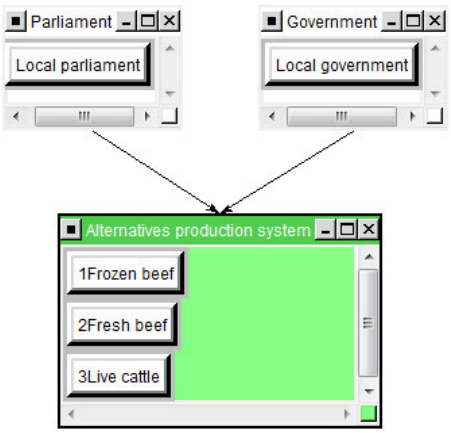
Appendix Figure 5. Decision Network In RPH Technology Advancement for Technologi Control Criteria On Benefits



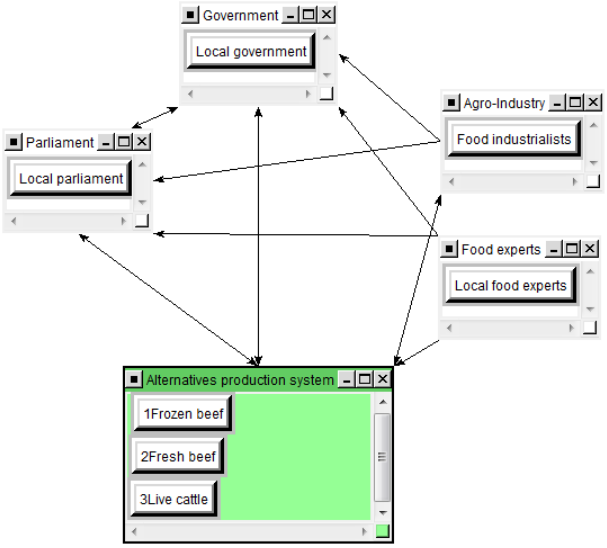
Appendix Figure 6. Decision Networks In “ASUH” Product Sales Subnet On Opportunities



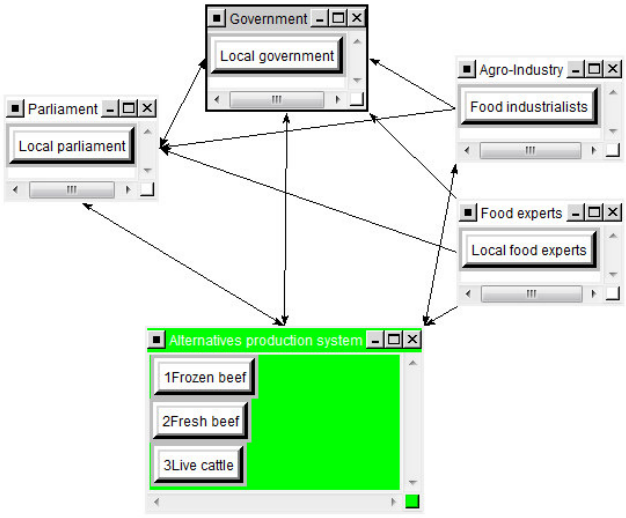
Appendix Figure 7. Decision Networks In the New Business (Split-off) Development Subnet On Opportunities



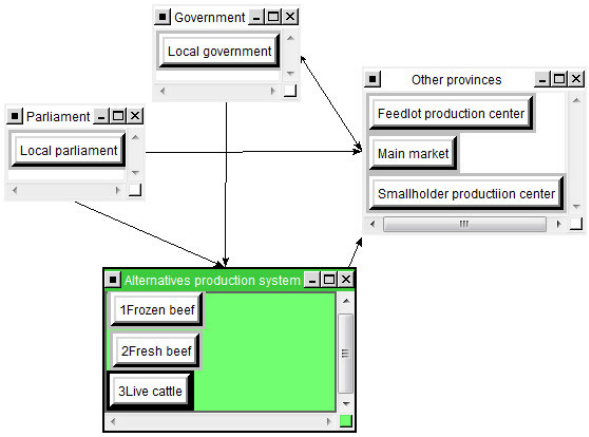
Appendix Figure 8. Decision Networks in Initial Cost Subnet for Economic Control Criteria On Costs



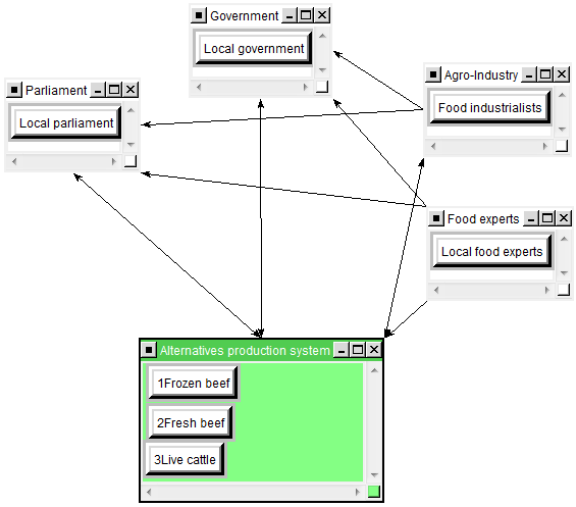
Appendix Figure 9. Decision Networks in Needs for Specific Business Model Subnet for Economic Control Criteria On Costs



Appendix Figure 10. Decision Networks In Institution of Farmers Subnet for Social Control Criteria On Costs



Appendix Figure 11. Decision Networks in Business Competition Subnet On Risks



Appendix Figure 12. Decision Networks in Production Process Failure Subnet On Risks

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