Assessment of Sustainable Food Diversification Development Model in West Java, Indonesia

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Abstract

Food diversification is often doubtful as population increases in a faster rate than food productivity. Not to mention land transformation and environmental issues, which are hampering agriculture? Thus, food security cannot be achieved by only relying on import and food diversification policies. There are many food diversification policies that have been legalized and adopted in Indonesia. However, due to flaws in its formulation and dissemination processes, most of them ended up in the desks. This article aims to assess a more sustainable food diversification development model, which guarantees food security. The program's performance, dominant influencing elements, and models were analysed by using SEM. 500 respondents spread all over West Java were interviewed in order to gain required information and data. The results showed that the level of food diversification in West Java is considered high. Nevertheless, there are biases which were caused by food import and diverse consumption behaviour. That said, production and distribution diversification based on local food is getting feeble. Biases were also found in consumption behaviour, which is mixed between rice and flour. Whereas for maize and tuber, although it has high production level, maize and tuber are mostly produced for animal feed and raw material for bioenergy. Cultural value of local food production, distribution, and consumption is diminishing both internally (from the society) and externally. A sustainable food diversification model is then suggested to be based on democracy and community.

Keywords: model, diversification, food, democracy, community, sustainability

Introduction

Since 2015, the Indonesian government has put food security as a part of national security, because a strong and stable food security is one of indicators for food sovereignty.The problem is that since 1998, national and global food security is experiencing stress due to global warming. The FAO (2014) identified that there are around 805 million of lives who lived below the standards. FAO's analysis (2015) for global food development between 2005-2015 shows that an increasing trend in the number of people who are located below the line for developed countries, underdeveloped countries, and even for countries that are food producers, including Indonesia. Natural disasters such as floods, droughts, and extreme pest attacks are considered as major challenges, which have real impact toward food production process, pattern, and yields in Indonesia (Rizaldi Boer, 2013).

Number of population and increases in middle class society in Indonesia have increased the demands for food (Table 1), requiring an improvement in the production level.UNDP (2014) reported that Indonesian Society Development Index went up from 0.681 in 2012 to 0.684 in 2013, which caused an increased consumption and consumer's preference for food quality. Ideally, the ever increasing demands on food have to be balanced by the increase of national food stock. However, due to agricultural pressures that are caused by various aspects, Indonesia has to rely on import to fulfil its food demands. The latest agricultural census (2013) revealed that within the past ten years (2003-2013), the population of farmers decreased by the number of 979.867 households.

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Table 1: Indonesian Food Demands Prediction in 2030

Types	Consumption (capita/year)		Demands	Production	Deficit
	2030	2001			
Rice	90 kg		36 m tonnes	29 m tonnes	7 m tonnes
Meat	15 kg		6 m tonnes	2 m tonnes	4 m tonnes
Egg	90 pcs		36 bpcs	12,6 bpcs	23,4 bpcs
Milk	12 lt		4,8 b litres	1,2 b litres	3,2 b litres
Sugar	25 kg		10 m tonnes	1,9 m tonnes	7,9 m tonnes
Chicken	12 kg		4,8 m tonnes	0,75 m tonnes	4 m tonnes

Source: Centre for Social Empowerment, 2011

Although food import is common, limited world's food stock has to be taken in to account. IFPRI (2001) reported that since 1998, food stock in the global market has been decreasing by 100 million tonnes annually. Therefore, the increasing food demands cannot be fulfilled by relying on import, self-sufficiency has to be improved. Food homogeneity is not an option either; diversification is a more logical solution. Food diversification is needed not only to fulfil food demand, but also to preserve Indonesian food variance, which nearly wiped out of the society since the year 2000. Paradox with that issue, wheat based consumption (flour and flour based food) keeps increasing. A study by Ariani (2010) stressed that Indonesian consumption behaviour is biased between flour and rice. This is an irony because Indonesia is one of largest producers for cassava, maize, sorghum, and other tuber and cereals, which are supposed to be in line with rice. Sustainable agriculture point of view sees that food diversification is one of the ways to reach food security. Consequently, food diversification has to be re-internalized. Indonesia is rich with food variance; however, its utilization is still not optimum. This is due to under value of society, lack of governmental support, diminishing pride of locality in the young generation, and the strengthened import corporations. Historically, food diversification policies had been running since the 90s, but it never reached its goal, which is mostly due to its unsustainable design.

Although Indonesia has a lot of cases of local food diversification, in practice, it does not have any sustainable food diversification model. The institutionalization of local food diversification and security had proved to be failed to be generalized in Asia and Africa (Fonchingong et al., 2003; Machfoedz, 2014). The failure, which was followed by cultural degradation, was caused by modern food security model, which promotes green revolution (Tran Thi Ut et al., 2006; Mariyono et al., 2010). Therefore, there is urgency in the search for an integrative, innovative, and accommodative food diversification development model, which also adaptive to the localities. This study aims to analyse the performance of public food diversification, its dominant influencing factors, and to design a sustainable food diversification development model.

Theoretical Framework

Constitution number 18/2012 defines food diversification as an effort to increase food stock, which is based on local resources and is conducted in order to: 1) fulfil a diverse, balanced and safe consumption pattern; 2) develop food entrepreneurship; and/or 3) increase civic welfare. This can be done through the application of diversification rules, local food optimization, technology improvement, developing an incentive system for local food processing business, (re)introduction different food source, agriculture and fishery diversification, improving the stock and access to seeds, optimizing land use, developing local food processing industry and small business. Sustainable food diversification is defined as a local food diversification that is sustainable socially, economically, and ecologically; which also prioritizes local food.

Food diversification is considered sustainable if it is able to develop the potency of existing local food. Local food is locally produced food (region, area, community), which has social, economy, consumption and ecological purpose. Local wisdom and cultural based approaches will provide opportunities for local population to develop their resources potencies in order to build a sustainable system that support civic needs fulfilment for food and nutrition. Thus, this will lead to the accomplishment of household's food security, enhancement of household's income, improvement of local food quality and image, and even increasing farmers' on farm and off farm skills(Bureau of Food Security, 2014).There are two types of food diversification: 1) Horizontal diversification, an effort to change paddy based agriculture to more varied staple food commodities such as maize, nuts, and tuber; and 2) Vertical diversification, an effort that focuses more on post-harvest management, including food processing industry to produce more varied processed food.

Food diversification can only be achieved by applying a holistic and systemic perspective on production, distribution, and consumption level. Food diversification can be used as an instrument to dig the potencies that lay in local and other food. The societies' dependency on rice had put pressures on local sources of carbohydrate. Consumption on diverse food will be able to fulfil the needs for nutrition, so that it can optimally increase local welfare. Food diversification has to offer options for individuals to develop more varieties not only in source for carbohydrate, but also for proteins, vitamins, and minerals. The biggest challenge lies in the consumption level, where the consumption culture has to be transformed. Recall and record methods were used to gain data about intake history and frequency in the survey of diverse food consumption (Gibson, 2005).

Between the dimensions of diverse food production and consumption, distribution holds an important role in the successfulness of food diversification effort. Distribution bridges the production and demand for consumption. Optimizing food distribution is influenced by physical and economical accesses of the areas, time, and individual, which then leads to the construction of food distribution pattern. Previous empirical studies showed that national food supply does not necessarily guarantee food security in household level. There are still many cases where households are not able to fulfil their needs for food, although in the national level, the average food supply is considered to be sufficient for all the population. Several famine incidents in some countries (Bangladesh, India, and some of African countries) still exist. Those empirical prove showed that national food security cannot be seen only in the macro level, but also has to cover the micro level. Therefore, national food availability paradigm is not proper to be the used as a base for policies which are supporting individual and household's food security (Simatupang, 2007).

The effectiveness of food diversification efforts has to include the aspect of availability, distribution, and consumption, which then classified to external and internal factors. Food availability, accessibility, and utility are internal factors that influence food diversification. Three of them are influenced by production input (land, water, human resource, technology), institutions, and culture. Hanani (2009) argues that food availability depends on production, food supply, external food sources, and aid. According to national food security system, external factors of food availability cover policies, global food situation, and strategic environment.

However, Hendayana et al (2013) stated that food policies are not always supportive toward food diversification. Dulmansyah (2002) argues that food production improvement can be done by embedding ecological balance in an effective technology, which is based on the environment. Djauhari (2013) states that household's expenditures influence the consumption pattern for diverse food.

Methods

This study used positivism paradigm and was designed quantitatively, with explanatory survey method. The dependent variable is sustainable food diversification, and the independent variables are external and internal factors. Survey was done by descriptive and verifying survey methods. The targeted population was specific population which have relevancy with the purpose of this study, which consist of individuals, and the heads and decision makers of the family. The subject of this study was West Java societies, who have roles as consumers, producers, distributors, and other utilizers. While the object of this study was the performance of food diversification effort and its dominant influencing factors, model, strategy, and policies. The study was conducted in various locations that represent the coverage of West Java area. In the Northern part (Cirebon Regency), the Central part (Purwakarta Regency), the Eastern part (Garut Regency), the Southern part (Sukabumi Regency), and the Western part (Cianjur Regency). Subsequently, smaller locations (municipalities and villages) which represent rural and urban characteristics were selected from each regency. The study was divided into seven phases along the time schedule between October 2015 and May 2016. The phases are: preparation (questionnaire formulation and testing, and legalities), data collection, data input, data cleaning (data selection and tabulation), analysis, result testing, modelling and model testing (Structure Equation Model), and finalization.

Figure 4.1: Food ecotype zone of West Java

The population is the total households in the study sites (approximately 9,836,528 lives), which are divided to Sukabumi (2,341,409), Cianjur (2.171.281), Purwakarta (852.521), Garut (2.404.121) dan Cirebon (2.067.196). Then, from each regency, 100 respondents were selected randomly until sampling quota of 500 was reached. Based on West Java agro ecosystem characteristics, the Northern part is dominated by paddy farmers, the Central part is dominated by horticulture in the highlands and second crops in middle grounds, while the Southern part is dominated by second crops and dry land farming and estates. Primary data were collected through structured and semi-structured interviews. Secondary data were collected through literature study and document analysis. As one of the main research instruments, the questionnaire was first tested for its validity and reliability, in order to get accurate and consistent data (Table 1).

Table 1: Research Instrument Reliability

Code	Name	Coefficient Reliability ($\square$)
X_1	Internal Factor	0.95
X_2	External Factor	0.99
Y_1	Food Diversification	0.98
Y_2	Food Security	0.98

$\square = 0.05$

Collected primary and secondary data were then cleaned and analysed by using statistical approaches, which convey descriptive analysis, correlational (Pearson Product Moment [r]), difference analysis, and Structural Equation Modelling (SEM) analysis (AMOS, PLS, and LISREL). The main feature is the construction of hypothetical model of structural equation, which is based on causal analysis logical framework (Figure1).
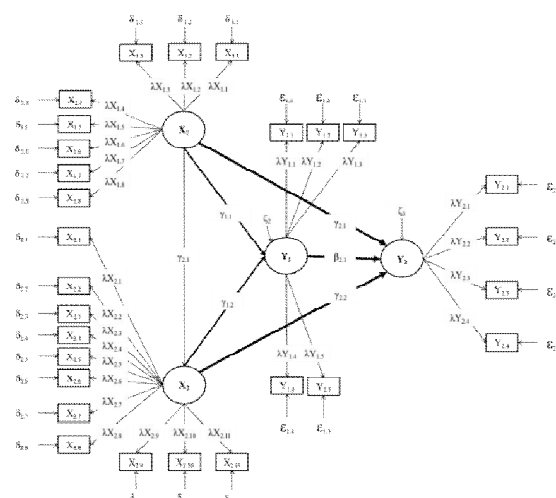

Figure 1: Research Hypothetical Model Diagram

Keterangan:

βi   = endogenous variable influence to other endogenous variable coefficient matrix;
γi   =exogenous variable influence coefficient matrix (X latent changer);
X   = exogenous manifest variable;
Y   = endogenous manifest variable;
λX   =exogenous manifest variable weight coefficient;
λY   = endogenous manifest variable weight coefficient;
δ   =defiance in X manifest variable measurement;
ξ   =X latent variable;
ε   = defiance in Y manifest variable measurement.
X1   = Internal factors
X1.1   = Socio Economic Characteristics
X1.2   = Decision
X1.3   = Motivation
X1.4   = Socio-Culture
X1.5   = Access to productive resource
X1.6   = Technology application and ICT
X1.7   = Agricultural Lands
X2   = External Factor
X2.1   = Market
X2.2   = Facilities
X2.3   = Mass Media and ICT
X2.4   = Global and National Food Policies
X2.5   = Extension
X2.6   = Corporation
X2.7   = Training and Education Institutes
X2.8   = NGOs
X2.9   = Communities
X2.10   = Cooperatives
X2.11   = Environment (agroecosystem)
Y1   = Food Diversification
Y1.1   = Daily Consumption Pattern
Y1.2   = Seasonal Consumption Pattern
Y1.3   = Annual Consumption Pattern
Y1.4   = Food Production Pattern
Y1.5   = Food Distribution Pattern
Y2   = Food Security
Y2.1   = Food Availability
Y2.2   = Access to Food
Y2.3   = Food Properness
Y2.4   = Food Utilization

SEM analysis started by confirmatory factor analysis (CFA) in order to generate the most dominant indicators, which reflect the determinant of this research's variables. The steps in CFA test are: 1) to check the presence of more than 1 Standardized Loading Factor (SLF) for model reparation; 2) checking the ability of indicators in reflecting the variables by individually testing the meanings of each indicator (if t test value is less than 1.96 then the indicator will be excluded from the model) and evaluating the SLF of indicators, if it's less than 0.5 it is excluded from the model;and 3) to test the robustness of the model with GFT (Goodness and Fit Test) $\geq$ 0,05 (from p-value chi-square test), RMSEA (root mean square error of approximation) value$\leq$ 0,08, CFI (comparative fit index) value$\geq$ 0,9, GFI (goodness of fit index) value$\geq$ 0,9 and AGFI (adjusted goodness of fit index) value $\geq$ 0,9. For comparing hypothetical model with base model, NFI (Normed Fit Index) $\geq$ 0,9 was used.

Results and Discussions

Food diversification is partially perceived by most of the people, bureaucrats, governments, and technocrats (academician and researcher) as diversity of food consumption. It is ironic, considering Anthony Giddens's statement that food diversification is not only about consumption behaviour, but it is also a chain of process and actions, which starts from production, distribution, processing, and consumption. Processing diversification includes creation, innovation, and industrial diversification. Consumption diversification is the lowest part of the chain from the perspective of added value, but it has the most existence due to the passive feature of the consumers. This has pushed Indonesia into biased import, colonise, and unproductive diversification.

The consumption behaviour of West Java people is considered as varied (68.89%) for carbohydrate and protein from animal and plant based sources. However, rice is still dominant (90%), and the needs for meat based protein is still low. There are 29.80 % of the population who still have low consumption diversification pattern, especially those who are less fortunate. The average consumption pattern per season is high (68.80%), for both rainy and dry season. Though, seasonal food consumption (38.6%) is lower than daily food consumption (39.2%). West Java seasonal food consumption pattern is also high, especially for carbohydrate (rice, noodle, and starch), meat based protein (egg, meat, fish), and plant based protein (beans). Moreover, the consumption pattern is still improvable, if local food diversification efforts were applied. The rate of production pattern is diminishing in the society, and even there is a bias in paddy farmers (28.60%) and maize farmers (3.36%).

Diversified production is being left by the society due to the increasing availability of food in the market (kiosks, shops, market). Homogeneity has an increasing trend, especially for intensive paddy and maize farming. Bias in the production level lies in on farm activities, and declining productivity due to various agricultural pressures. The result shows that the bias in production pattern influences the distribution pattern. Stability only occur in paddy and maize farming. In the practice, the distribution pattern for maize and paddy is still low (44.40%), and just covering village and district area. This happened due to the presence of some actors (middle men) who are monopolizing the distribution of the commodity. There are some actors who are cooperating with the government, who although have broader distribution channels, but mostly restricted to the cities. While for maize, the distribution has reached to the national and even international level (4.20%).

Statistically, the result (Figure 2) shows that the most contributing factor is food production pattern (Y1.4) and distribution pattern (Y1.5). While food availability (Y2.1) and access to food (Y2.2) contributed to food security. Food diversification and food security is directly influenced by socio economic characteristics (X1), technology, communication and information (X6), access to productive resources, especially to market (X5), decision (X2, and motivation (X3).Food diversification and security is also positively and significantly influenced by infrastructures (X9), mass media and ICT (X10), global and national food policies (X11), extension activities (X12), education and research institutes (X14), NGOs (X15), community (X16), and cooperative (X17). In Figure 3, we can see that food security (Y2) is directly influenced by food diversification (Y1). That said, the more sustainable food diversification being carried out, the more improved food security will be. Food security is also affected by internal factor (X1) and external factor (X2), aside of indirectly influenced by X1 through Y1.

Figure 3 also shows that partially, food diversification is constructed by five internal factors, namely: 1) access to productive resources, especially lands, production input, innovation and information, market, and supporting institutions; 2) the application of science, technology and ICT, especially related to access to market innovation and information, and information of climate, and standardization;3) decision in applying food diversification is a manifestation of farmers' autonomy in deciding their production pattern, which needs to be enhanced due to the high dependency on homogeneity in the society; 4) diversification motivation, for consumption, production, and/or distribution, has a very strong influence to food diversification efforts, and food security; and 5) characteristics of the society.
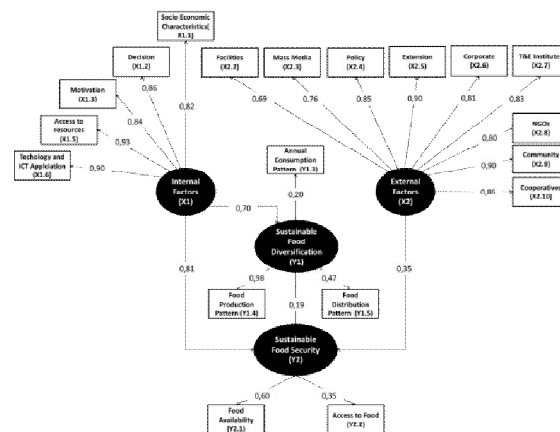

Figure 3: Cluster Structural Model of Dominant Influencing Factors for Food Security and Diversification

There are nine external factors which constructed the food security and diversification: 1) community as a social capital in food diversification effort; 2) multi stakeholders and multi disciplines based extension, with pluralistic methods, which are conducted by young generation; 3) the return of cooperative's role as a rural democracy body, particularlyin providing an efficient and effective services and control for the society, and as business partner for private and government; 4) food diversification policies, which have to include locality and community; 5) education and training organization, which generates and applies innovation and technology; 6) corporation's ability to absorb and distribute various local food has to be enhanced, and its roles which can lead to food homogeneity and import has to be reduced; 7) mass media nowadays has the power to direct public opinion, thus, its support to the local food diversification has to be enhanced; 8) NGOs roles in agriculture, especially in organic agriculture, environmental consulting, conservation, and food diversification efforts are still need to be developed; and 9) infrastructures, mainly roads and access to water (irrigation, dam, etc.), are one of key elements in reaching food diversification and food security.

Food diversification actors are only positively and significantly influenced by internal factors, while food security is influenced by external factors. This means that reaching food diversification has to be supported by the augmentation of the society's internal factors, especially the support towards local food heterogeneity, access to productive resources, motivation, decision, science and technology, and socio economical aspects. Accordingly, in phase 1, internal factors enhancement is a priority. Societies moral, trust, mental, commitment, and support improvement became the first step. In phase 2, external factors (community, extension, cooperative, policies, trainings and educations, NGOs, infrastructures) development will be carried out. Historically, food diversification existed in community that is why it's relevant if we take the sense of communal into account in developing sustainable food diversification efforts. The other external factor that needs to be improved is cooperative, which in Western terminology knew as cooperatives. Ideally, cooperatives found its momentum in the era of community based creative economy. As a body or legality, cooperative is needed in order to improve a sustainable competitiveness and transparency era. Government's policies are sure needed in order to support its presence. Institutionally, creative economic approach requires synergy and collaboration among academician, businessmen, community, and government. In the process, this model is known as triple helix model, Penta helix model, and multi helix model.

The limited human resources, due to under value of the young generation or aging problem, have accelerated the rate of mechanization in Indonesia. Consequently, the foundation of food security and diversification realisation is infrastructures and facilities improvement. A democratic food diversification development model values commodities and global value. Albeit, it prioritizes moral, nature heterogeneity, locality, participatory, nationalism, identity, and cultural pattern of the nation (Figure 4 and Figure 5). It is based on the community and productive resources. Democratic model was designed by integrating, synergizing, and collaborating the farmers' community as its core. This is done through active and productive participation of the academician, private, government, NGOs, cooperatives, and other rural communities.Community and productive resources were placed as the base of the model, due to the presence of collectiveness as a productive social capital. Collectiveness in food management and investment will be a solution to the implementation of mechanization and anticipation of diminishing labour. Aside of that, collectiveness will also be helpful for young generations who have limited access to resources, mainly lands and financial capital. Partnership in food investment is also potential to be made with defence and security institutions.
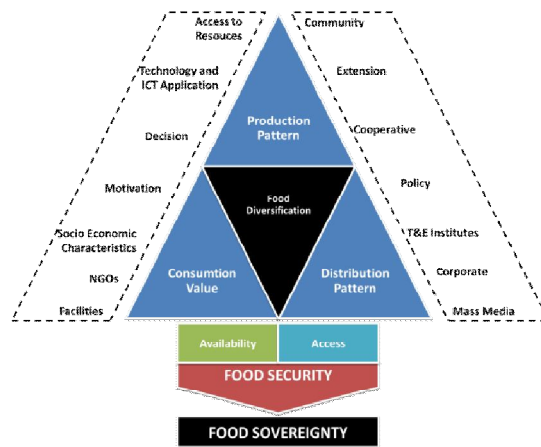

Figure 4: Community Based Democratic Food Diversification Development Model
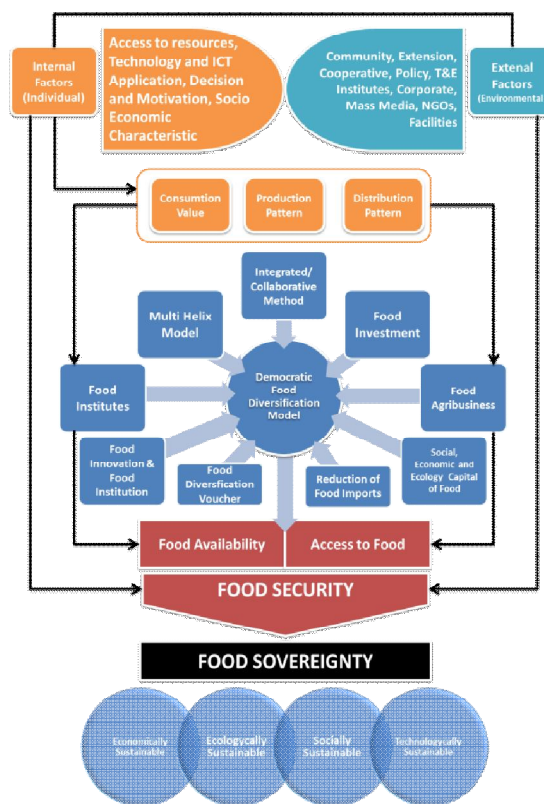

Figure 5: Sustainable Food Diversification Model

The aim of sustainable food diversification development is to reach food security and sustainable agricultural practices, which covers its economic, social, ecology, and technology. Economic sustainability refers to the societies welfare, mainly farmers. The core of economic sustainability is the contribution of food's added value, which determines the farmers' income and welfare. This will attract the youths to be back to the farm. Social sustainability refers to the regeneration of actors in food production by sustainably creating jobs and businesses. Ecological sustainability refers to the conservation and regeneration of natural resources, which includes more environmental friendly farming practices. Technological sustainability refers to the internalization of external sourced technology and innovation, which are adaptive and can be combined with local technology and innovation, and also are supporting environmental friendly practices both in on farm (farming) and off farm activities (agro-industry).

Conclusions

The performance of food diversification policies is so far in a good position, which covers production, distribution, and consumption level. Consumption pattern is considered as varied. However, there are still 29.80 percent of the population who still have low food consumption disparities.The societies seasonal consumption pattern is rather high, specifically for carbohydrates and proteins. Food production pattern that is being practiced by the society is not varying anymore, due to the domination of paddy and maize.

Food distribution pattern is running well, albeit, it only applies for maize and paddy. Diversification performance was positively and significantly constructed by production, consumption, and distribution pattern, and was only determined by internal factors. Internal factors have a significant influence toward food diversification and food security, while external factors only influence food security. That is to say those internal factors are required in the whole process of food security and diversification efforts, while external factors are only needed to enhance food security.

In this case, sustainable food diversification development model has to be based on the democracy and community. Policies are needed in order to assess, prepare, and develop a sustainable food diversification model in all area of Indonesia, which can provide suggestions for national future food diversification development. Furthermore, a prototype of democratic and community based food diversification development model is compulsory.

References

Ariani, M. 2010. Food Consumption Diversification in Indonesia: Between Hope and Reality. Centre Socio Economic and Policy. Bogor

Food Security Agency. Food Diversification 2011. The Road Map 2011-2015. Food Security Agency. The Ministry of Agriculture of the Republic of Indonesia. Jakarta

Djauhari, A. 2013. Food Diversification and Transformation of Agricultural Development. Structural Analysis of Household Expenditure on Food Consumption Diversification Support. 204-215. Research and Development of the Ministry of Agriculture. IAARD Press. Bogor

Dulmansyah, I. 2002. Availability and Food Consumption of Lampung Population (a Resource Analysis of Food and Nutritional Status of Disadvantaged Regions Population of Lampung During Crisis Years (1995-1999). Dissertation. Bogor Agricultural Institute. Bogor

FAO. 1996. Rome Declaration on World Food Security and World Food Summit Plan of Action. Rome.

FAO. 2003. Trade Reforms And Food Security: Conceptualizing The Linkages. Rome.

FAO. 2014 Agricultural Market Impact of Future Growth in the Production of Biofuels. RomaUnited Nation and Development Program. 2014.

FAO. 2015. Food Outlook No. 4. Rome

Fonchingong CC, Fonjong LN. 2003. The Concept of Self-Reliance in Community Development Initiative in The Cameroon Grassfields. Nordic Journal of African Studies 12 (2): 196-219

Hanani, N. 2009. Food Security. Papers. Workshop on Food Security in East Java.

Hendrayana, R. and Ariani, M. 2013. Food Diversification and Transformation Development. The paradox of success of diversification. Case: West Nusa Tenggara Province. 246-263. Research and Development of the Ministry of Agriculture. IAARD Press. Bogor

IFPRI. 2001. What Goes Down Must Come Up: Global Food Prices Reach New Heights. IFPRI Forum March.

Ilham, N. 2006. Effectiveness of Food Price Policy Toward Food Security and Food Security and its Impact on Macroeconomic Stability. Dissertation. Postgraduateschool. Bogor Agricultural Institute. Bogor

Jayawinata, A. 2005. Impact of Macroeconomic Policies Against National Food Security. Dissertation. Postgraduateschool. Bogor Agricultural Institute. Bogor

Machfoedz, MM. 2014 Food Sovereignty: Between Legality Protection and Legalization of importation.

Mariyonoa J, Tom Kompasb and R. Quentin Graftonb. 2010. Shifting from the Green Revolution to environmentally sound policies: technological change in Indonesian rice agriculture. Journal of the Asia Pacific Economy. Volume 15, Issue 2, 2010

Saragih, B. 2010. Development of Advanced Global Agribusiness Market and Implications for Indonesia Agribusiness Development. Department of Agribusiness Economics and Management Faculty of IPB, Bogor.

Simatupang. 2007. Critical Analysis of Paradigm and Framework of National Food Security Policy. Agro Economic Research Forum, Volume 25, No. 1; 1-18. PSEKP. Bogor.

Gibson RS. 2005. Principle of Nutrional Assessment. New York. Oxford University Press

Tran Thi Ut and Kei Kajisa. 2006. The Impact of Green Revolution On Rice Production In Vietnam. The Developing Economies, XLIV-2 (June 2006): 167-89.