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PROCEEDING

1st International Conference on Food Security Innovation 2017

Emerging Global Food Innovation for Future Quality of Life

Le Dian Hotel, Serang
18 - 20 October, 2017

EDITORS :

Maman Fathurrohman
Aliudin
Amalia Sholehah
Erlina Yustanti

Project Implementation Unit
Islamic Development Bank
University of Sultan Ageng Tirtayasa

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University of Sultan Ageng Tirtayasa

Proceeding

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1st International Conference on Food Security Innovation 2017

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PREFACE

Assalaamu'alaikum wa Rahmatullahi wa Barakatuh,

It is our great pleasure to join and to welcome all participants of International Conference on Food Security and Innovation (ICFSI) 2017 in Serang, Banten. I am happy to see this great work as part of collaborations among Universitas Sultan Ageng Tirtayasa, Universitas Mulawarman, Universitas Jember and Universitas Malang in the program of Islamic Development Bank (IDB) 4 in 1 Project. On this occasion, I would like to thank all the committee to organize this conference. Furthermore, the conference can be conducted successfully. I also congratulate all participants for their involvement and willingness to share their research findings and experiences in this conference.

Universitas Sultan Ageng Tirtayasa (called Untirta) is located in Banten Province, the western part of Java. Banten was established officially as a new province on 2000 and developed very rapidly especially to buffer the capital city, Jakarta. Besides consisting of several industrial areas in the North, Banten also has several agricultural sites in the South. That is one of the reasons why the Ministry of Research, Technology and Higher Education commissioned our University as a Center of Excellence for Food Security with the funding support from Islamic Development Bank (IDB) which is around 700 billion rupiah. We are currently constructing an integrated campus in Sindangsari, Pabuaran, Serang. Some of the funds are allocated for Soft Programs that will support Untirta as a Center of Excellence in Food Security.

I wish you all find opportunity to get new friendship and network throughout this conference that will be beneficially in the future.

Serang, December 2017

Rector,
University of Sultan Ageng Tirtayasa

Prof. Dr. H. Sholeh Hidayat, M.Pd

FOREWORD

Bismillahirrohmannirahim,
Assalaamu'alaikum wa Rahmatullahi wa Barakatuh,

We would like to welcome our colleagues to attend the first International Conference on Food Security Innovation (ICFSI) 2017 in Serang, Banten Province on 18-20 October 2017.

The ICFSI 2017 is held in Banten Province "This city has a lot of treasure to whom that likes history". Such as the ruins of Surosowan Palace, Banten Great Mosque, Kaibon Palace, Speelwijk fortress and Chinese temple Avalokiteshvara, and the harbor of Banten, Karangantu that still used these days. I hope this conference will become a great event for all researchers and professionals to share their findings and development to the world in the field of food security.

This conference is coordinated by the research consortia to achieve "I-CEFORY (Indonesia Center of Excellence for Food Security)" in 2019. Research Clusters in Center of Excellence for Food Security consist of four clusters: availability, access, stabilization, and utilization. This conference is collaboration with the program of Islamic Development Bank (IDB) 4 in 1 Project: University of Sultan Ageng Tirtayasa, University of Mulawarman, University of Jember and University of Malang.

My heartful gratitude is dedicated to organizing committee members for their generous effort and contribution toward the success of the ICFSI 2017.

Serang, December 2017

Head of Reserch Consortia

Prof. Dr. Ir. Kartina AM, MP.

REPORTS THE COMMITTEE

In the name of Allah, Most Gracious, Most Merciful

Welcome to the first International Conference on Food Security Innovation (ICFSI) 2017 in Serang, Banten. The ICFSI 2017 has a theme "Emerging Global Food Innovation for Future Quality of Life". This forum presents the latest research and results of scientist related to food security. The conference was attended by five keynote speakers that represents governments and academics. The five keynote speakers are Prof. Dr. H. Mohamad Nasir, Ph. D., Ak., Prof. Tofael Ahamed, Ph.D., Prof. Dr.-Ing. Bernd Noche, Prof. Dr. Herry Suhardiyanto, M.Sc. and Prof. Dr. Fazilah Bt. Ariffin. All the authors are related to the Food Security community from various countries including Germany, Japan, Malaysia, and Indonesia in amount of 128 total papers. Such papers consist of 1 author from Canada, 5 authors from Germany, 4 authors from Japan, 1 author from South Korea and 309 authors from Indonesia.

Therefore, this conference not only gives us knowledge, but also a great opportunity to share experiences in technical, sciences, socials and regulatory terms. This conference could not have been made possible without supporting from Banten Province Government, Government Tourism Office, ISLI (Indonesian Supply Chain and Logistics Institute), BNI 46, Total-Lab, Tamara Overseas Corporindo Inc., Spektris Metalab Inc., Vanadia Utama Inc., New Module International Inc., Infiniti Bioanalitika Solusindo Inc., Nano Center Indonesia, Hilab Sciencetama Inc., Magna Sardo, Ditek Jaya, and Genecraft.

I would like to express my sincere thanks to the organizers and especially to the speakers, presenters and all participants. I really appreciate their dedication and hardworking.

Serang, December 2017

Chairman

Dr.-Ing. Asep Ridwan, MT

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1st International Conference on Food Security Innovation

"Emerging Global Food Innovation for Future Quality of Life"

Keynote Speaker

1. Prof. H. Mohamad Nasir, Ph.D., Ak.
   Ministry of Research, Technology and Higher Education

2. Associate Professor Tofael Ahamed, Ph.D
   Tsukuba University - Japan

3. Prof. Dr. Bernd Noche
   Universitat Duisburg Essen – Germany

4. Prof. Dr. Herry Suhardiyanto, M.Sc
   Bogor Agriculture University – Indonesia

5. Prof. Dr. Fazilah Bt. Ariffin
   Universiti Sains Malaysia – Malaysia

NEW DEVELOPMENTS AND EMERGING TRENDS IN AGRICULTURAL MECHANIZATION TECHNOLOGIES TO IMPROVE AGRICULTURAL PRODUCTIVITY FOR ENSURING FOOD SECURITY

Associate Professor Tofael Ahamed, Ph.D

Tsukuba University – Japan

Agricultural Mechanization is one of the great achievements in the 20th century. The significant contributions of mechanization cover minimization of labor, timeliness of operations, input management using precision agriculture, auto-steering system, automation and control, sensing systems, plants growth modeling, and man and machine communications. The mechanization increases pre-field operation of optimizations (planning season), in-field operation optimization (growing season) and post optimization (harvesting season) of crop production system. One of the problems throughout the Asian countries is the labor shortage besides the optimization of machines and targeting agronomy. The demand for agricultural workforce has increasing worldwide with the growing need for food production. In the developed countries, farmers and researchers emphasized on the developments and adaptation of agricultural mechanization technologies due to the large scale of farms. On the contrary, developing regions from Asia, Africa and Latin America are relied on the conventional technologies and small-scales machineries. However, to run the farms efficiently, regardless of size and advanced technologies, stakeholders of the agricultural sectors are now addressing the labor scarcity in the field level. This keynote paper attempted to find out the recent trends of machinery and shortages of agricultural workforce in the Southeast Asian countries such as Japan, China, Indonesia, Malaysia, Thailand, India, Pakistan and Bangladesh. Data shows that the number of farmers in Japan has reduced 16% during last 6 years. The most considering issue is 48% of the current farmers are 68 years old or above. China, the world's most populous country, the number of employed persons in the agriculture has declined to 11% from 2009 to 2012. A study conducted in the Jiangsu province of China, showed that the total average age of the farmers was 56.6 years (Guancheng, 2015). In Indonesia, 16% of total agricultural labor force has declined during 2003 to 2013. Due to the local labor shortages in plantation sector, Malaysia depends on the foreign workers. The data showed that, the 45% of the workers are more than 55 years older or above. In Thailand, the percentage of agricultural labor was more than 30% in 2004, which was decreased to 25% in 2014. The numbers of agricultural labors have also declined in different states of India. The shift of agricultural labor force was not notable in Pakistan from 1981 to 2009, whereas in Bangladesh the percentage of agricultural workforce has declined from 67% to 47.7% during 2001 to 2010. The overall data of respective countries showing evidence that the labor crisis situation in food production is getting worse in the coming days. In addition, the farmers are old and young generations are showing interest more on urbanization's jobs rather agriculture in rural areas. Therefore, the labor shortage would be a threat for sustainability in crop production and food security in the Asian regions. To increase the crop production the emerging technologies and automations are required to motivate the young and reduced the drudgery of aged farmers. Agricultural mechanization could vary according to the levels and site-specific for Asian countries to increase the productivity based on soil and environment.

On the other hand, crop production varies spatially and temporally within the field boundaries depending on the soil and environmental conditions. The major concern of variability for agronomic inputs addresses how best to intervene in the right place, at the right time and in the right quantity to

improve the potential yield of crops and feedstock. Various types of sensors and communication protocols, including laser range finders, RTK-GPS, multi-spectral cameras, thermal imagery, odometers, and fiber optic gyroscope are developed in the recent years to increase the accuracy positioning and sensing systems. Furthermore, the Decision Support Systems (DSS) focuses on the high spatial and temporal resolutions of remote sensing images, which are major factors for accurate mapping of organic matter, soil moisture, and soil nutrients for adopting precision agriculture technology to maximize the crop yield over the growing seasons. ICT plays a key role in improving the availability of agricultural production and market information. Experience with ICT in rural areas suggests that recent technological advances require a different approach for agricultural development. Previously, agricultural machinery was strongly aimed towards the mechanization of agricultural processes. This target remains, but technological advances allow for a broader target. As sensors have advanced, ICT can now connect with bioproduction systems in a variety of ways using the concepts with clouds. The three major areas of ICT involvement are: "machine optimization", "targeting agronomy" and "data management" and these three are closely related and strongly connected with each other. Total management of agricultural products and biomass from field to consumption is very important to maintain environmental, occupational safety for the farmer, and consumer safety. All this total management carries huge amounts of data, which sometimes referred as data lakes, or data warehouse. In the recent ICT developments, Hadoop Distributed File System (HDFS) storage got importance, specially handling the metadata of yield information which spatially distributed and very much site-specific with micro-climatic adaptations. The big data came out with the potentials with cloud system to link all these data together with accessibility and proper analytics in site-specific decision for crop production, processing and marketing. The machinery development has been advanced over the years, now it is needed the remote access to on-board machinery optimization for variable application such as planting, irrigation, fertilizer and pesticides. On the other hand, it is required to unlock the genetic potential of crops for micro-climatic adaptation and agronomic decisions with weather variability. These all of the recent trends and technologies needs to inline with food production to increase the productivity, address the labor scarcity, and innovation in application with site-specific approaches to ensure the food security in the southeast Asian countries.

ADVANCED INTERNET OF THINGS FRAMEWORK IN THE FOOD SUPPLY CHAIN NETWORK TOWARDS FOOD RESILIENCE

Prof. Dr. Bernd Noche

Universitat Duisburg – Germany

In term of food security, Indonesia faced several predicaments, i.e. huge population, limited amount of agricultural land, lack of integration in production, difficulty to improve agricultural commodities and price instability. The volatile price is mostly caused by inefficient supply chain. This paper presents a scientific insight for advanced supply chain planning concerning food resilience. Authors utilize the internet of thing framework for governing food industry more integrated. It employs holistic approach where the staple food is dependent on various aspects from upstream to downstream. Besides that, a centralized information system on a national level is proposed. It would be a control tower or command center that share food information and monitor the entire process. The government could maintain the quality of the food, sustainability, and price when this breakthrough is developed. The results of theoretical arguments, and conceptual design offer a digitalization pattern in an efficient food supply chain

REALIZING RESEARCH WITH IMPACT : IPB LESSONS LEARNED TO STRENGTHEN NATIONAL FOOD SECURITY

Prof. Dr. Herry Suhardiyanto, M.Sc

Bogor Agriculture University – Indonesia

Higher education role in developing country is changing, gradually moving from teaching based university to research based university within the framework of three pillars of "Tridharma", namely education, research and community services. In addition, however, knowledge resulted from research activities at the universities are expected to contribute also to the national economic development in which a university pays more attention on the down-streaming the research results. Under current condition of various university governance status, there have been prospects and challenges to be faced with respects to research capacity, policy as well as institutional aspects. Bogor Agricultural University (IPB) has evaluated its future direction towards becoming techno-socio entrepreneurial university. Considering the global trends on food and agriculture as well as national development agenda, IPB has in advance prepared its strategic research agenda on food sector in order to accelerate the impacts of research. The flow of knowledge from research to adoption is supported by the institutional arrangement to create good research atmosphere including the role of IPB holding company, Bogor Life Science and Technology (BLST Ltd.). This paper will discuss several examples of innovation disseminated to the stakeholders that have already showed positive impacts such as a new type of paddy variety IPB-3S, Sekolah Peternakan Rakyat (Animal Husbandry Field School) SPR-1111, Budidaya Jenuh Air (Water Saturated Cultivation) for Soybean, Food Diversification Products (analog rice, corn noodle, sormeal etc). Impacts are observed through research based teaching, new markets, start-up companies, techno-preneurs, participation of stakeholders etc

FOOD PROCESSING TECHNOLOGY

Prof. Dr. Fazilah Bt. Ariffin

Universiti Sains Malaysia

Food is being processed meanly to preserve its freshness and quality. The current trend is to utilized "waste to wealth concept". This concept starts from manipulation of waste/by - products from food commodities to transform them into novel food products through various processing technologies. Waste from tuna processing, quail production and oil palm industries, for instance have hidden potential to be processed and converted into value-added ingredients /products such as calcium, collagen and syrup. Likewise, crops like cassava and nutmeg are benefited from enzymes/physical/chemicals- based processing technology to eradicate the toxic compounds founds in those crops that may pose safety and quality issues that hinder the newly developed products' potentials. Moreover, a humble ingredient like *nigella sativa* can be upgraded into whole new healthy yet convenience products to meet current market demand with foam mat drying technology. Additionally, the key factors driving the food processing technology in Malaysia will be covered in this talk

Islamic Development Bank
Research Consortia

Invited Speaker

1. Prof. Dr. Ir. Kartina, AM., MP.
   Universitas Sultan Ageng Tirtayasa

2. Prof. Dr. Bernatal Saragih, M.Si
   Universitas Mulawarman

3. Dr. Ir. Soenar Soekopitojo, M.Si
   Universitas Negeri Malang

4. Lenny Widjayanthi, SP., M.Sc., Ph.D
   Universitas Jember

5. Prof. Dr. Kudang Boro Seminar
   Bogor Agriculture University

Invited Speaker 1

Identification and Characterization of Local Food Ingredients of Baduy Ethnic to Support Food Security

Prof. Dr. Ir. Kartina, AM, MP. (Universitas Sultan Ageng Tirtayasa)

The food production of Baduy area is always surplus, because they store partially of the grain in the barn or house leuit. Baduy ethnic food security is strongly influenced by the environmental resources of the forest. The research used a survey method using snowball sampling. Based on the findings of research that the food staple of Baduy consisted of rice as primary food, vegetables (Hiris vegetable, Mantang vegetable, bamboo shoots vegetable) and fish, especially anchovies. Several types of Baduy local food are wajik, Opak, Uli, Rengginang, Tape, Gipang, Gemblong, Ulen, Getuk Dangdeur, Getuk Cau, and Wijen. The drinks that many consumed were sugar ginger, acid keranji, and wild honey as a local typical product. Other food ingredients non-rice were cassava, yams and taro. Baduy food handling typically was stored in the storage barn or house of leuit as part of the efforts to ensure food security of local ethnic Baduy

Invited Speaker 2

Analysis of Food Security and Identification of Dayak Local Food to Support Food Sovereignty

Prof. Dr. Bernatal Saragih, M.Si (Mulawarman University)

Alternative food development and local food exploration programs are essential to support the availability and diversification of food. This study aims to analyze food security and local food identification on Dayak ethnic in West Kutai Regency. Methods include identification conducted by survey method and indept interview to Dayak ethnic to explore potential of local food source, food security analysis done to commodity group in each region (sub-district). The commodity groups analyzed were foodstuffs group of carbohydrate sources and food sources of vegetable protein. Food used as the most energy source of four food crops such as rice, corn, cassava and sweet potato. Result Analysis Location Quotient (LQ) of food used as source of carbohydrate of rice, corn, cassava and sweet potato. These four commodities occupy large agricultural areas in West Kutai Regency. The result of LQ analysis shows that the four commodities are the mainstay commodities in each sub-district. There are only 3 out of 16 sub-districts which are rice surplus areas, and cassava is a food crop that can be used by the community as rice substitution food, because of its high production level. While the largest source of vegetable protein from three commodities of food crops such as soybeans, peanuts and green beans are relatively low protein sources. The low level of food security is mainly due to low planting area of plant food sources of vegetable protein. Cassava commodity is a mainstay commodity in most sub-districts, this is because the management is quite easy and people are accustomed to consuming cassava which can be used as food substitution of rice rice. The Dayak Kutai Barat ethnic group states that, five types of food plants are not cultivated or most often taken from the forest; Stenochlaena palustris Bedd (Red Fruit), Calamus sp (Rotan), Auricularia auricula-judae (Ear Mushroom), Dendrocalamus asper Backer (Bamboo), Colocasia esculenta Schott (Keladi). Vegetables Manihot uttilisima Pohl (cassava), Amaranthus spinous Linn (Spinach), Brassica rapa (Sawi), Ipomea aquatica Forsk (Kangkung)

and Vigna sinensis Endl, The most consumed vegetable species and potential from not wichn is cultivated or forest produce is the type of Stenochlaena palustris Bedd fern

Invited Speaker 3

The Diversity of Local Cuisine of the Tengger Tribe to Support Tourism In Indonesia

Dr. Ir. Soenar Soekopitojo, M.Si (Universitas Negeri Malang)

The study on culinary culture of the Tengger tribe is still limited, almost there is no written records for local cuisine of this ethnic group. The development of culinary tourism can create more job in culinary field to the improvement of economy and food security. The aims of this study are to identify and describe the variety of local cuisine of the Tengger tribe. Selection of research location was conducted with a purposive sampling. Data were collected through direct observation, interviews and documentation. Informant selection was based on snowball method. In total of 105 types of cuisine were recorded, consisting of 5 staple foods, 29 dishes of vegetable, 14 side dishes, 14 condiments, 37 snacks, 2 one dish meal, and 4 beverages. These were prepared with 61 food plants, not included animal foodstuff. Typical food plants for local cuisine of the Tengger tribe among others are semen, ranti, ketirem, grigit mushroom, cabai terong, and bawang teropong. Several of local cuisine are potential to be developed as ethnic foods to support tourism in Indonesia

Invited Speaker 4

Supporting Food Security Through Identification Of Local Food Of Ethnic Osing In Banyuwangi Regency-East Java

Lenny Widjayanthi, SP., M.Sc., Ph.D (Jember University)

Human needs food to survive, whoever he is, from whence, what age, in good health or illness. Food must be filled by everyone, because food is the main staple for everyone. Food is influenced by the availability of raw materials derived from the natural surroundings, this resulted in each region has its own food characteristics. The diversity of tribes with their culture throughout Indonesia is a nation's wealth. This wealth includes cultural forms that are supported by society. Each tribe has distinct cultural values, which distinguish their identity with other ethnic groups. One of the tribes in East Java is the Osing ethnic in Banyuwangi Regency. Ethnic Osing has a typical food that is usually consumed for daily food. This study aims to identify the food of ethnic Osing based on the function of food that is the main staple, cuisine for special events, snacks and drinks. Four sub-districts in Banyuwangi district were chosen as research areas, namely Blimbingsari, Giri, Glagah and Sempu sub-district. Method of determining the research area using purposive sampling. The respondents were 100 housewives selected incidentally at the time of the research. Data analysis using descriptive and inferential analysis. The results indicate that the ethnic food of Osing can be classified based on its cooking function that is main food, cuisine for special occasion, snack and beverage. Main food is cooked and consumed for daily food such as pecel pitik, sayur asem, nasi cawok, rujak soto, sayur kesrot, sayur tombol, while a dish for a special event that is pecel

pitik. Snacks such as: orok-orok, putu, uceng-uceng, ketan kirip, sumping, sesobo, kolpang while, beverages are: wedang ginger, wedang polo and temulawak

Invited Speaker 5

An Intelligent System for Early Detection of Food Crisis and Spatial-Based Decision Making of Potential Land Evaluation for Food Production

Prof. Dr. Kudang Boro Seminar (Bogor Agriculture University)

Food crisis is now becoming critical issue in the global world and thus becoming a great challenge for many countries to cope with. In this paper we discuss the utilization of intelligent computation to support early detection of food crisis and spatial-based decision making of potential land evaluation for food production. The intelligent part of the proposed system comprises fuzzy logic, artificial neural network, and dynamic system models to cope with multicriteria decision making for detecting early occurrences of food crisis and for examining the potential land for food production and food supply adequacy. The proposed system has been developed, implemented and tested with real data in Indonesia

Theme : Agriculture

Sub Theme :

1. Increasing Productivity
2. Identification of Local Resources of Nutrition
3. Improving Quality : Plant Breeding
4. Mapping Potential Areas
5. Food Sustainable Resources Access
6. Food Diversification
7. Food Processing Technology
8. Protecting Plant Germplasm
9. Sustainable Land Management
10. Food Nutrition

STATUS OF FOOD SECURITY IN BANTEN PROVINCE, INDONESIA

[1, 2*)] Weksi Budiaji, [1)] Ratna Mega Sari, [1)] Suherna

[1)] Agribusiness Department, Sultan Ageng Tirtayasa University, Indonesia
[2)] Institute of Applied Statistics and Computing, University of Natural Resource and Life Sciences, Austria

[*)] Correspondence e-mail: budiaji@untirta.ac.id

Abstract

This paper discusses the status of food security in Banten Province, Indonesia based on regional and city characteristics. Secondary data is used and is analyzed descriptively covering population dynamics, the population living in poverty, cereal production, disaster risk and soil types. Tangerang Region is found to have the largest population with the greatest number of people living in poverty among the regions and cities in Banten Province. Cereal production is dominated by the regions rather than the cities due to their vast area. Regarding arable land, flooding is the most threatening disaster in the major rice producing areas. In order to identify the distributions of regions and cities regarding food security, three indicator variables of food security dimensions are plotted, namely, cereal normative consumption, proportion of the population living in poverty, and proportion of malnourished babies. The three regions of Pandeglang Region, Lebak Region and Serang Region are grouped together in a less secure group.

Keywords : population, poverty, normative consumption, malnutrition, soil type

INTRODUCTION

Food (in) security has been extended from the secure, sufficient, and suitable supply of food for all persons to become a broader concept involving availability, accessibility, utilization, and stability concepts. The latter concept can be found in studies by Van Dijk and Meijerink (2014), and Coates (2013), which also discuss the food acceptability across many different cultures. The dimensions of food security have been prominent in the last two decades and become standard indicators for measuring food security status. Using these dimensions, FAO (2015) report that a total of 72 developing countries have achieved the Millennium Development Goal (MDG) 1c hunger target. As one of the developing countries, moreover, Indonesia has shown a positive performance with regard to food security progress.

Indonesia is able to improve the status of food security due to its continuous inspections. The Government of Indonesia via its FSC (Food Security Council) with WFP (World Food Program) cooperation has published a food security map as one of its food security monitoring tools at least three times in the years 2005, 2009, and 2015 (FSC and WFP, 2015). These FSC maps illustrate the food security status in all regions in Indonesia and the latest map shows that there are 58 regions categorized as being the most vulnerable.

One of the provinces that is able to change the status of food security into more secure status is Banten Province (FSC and WFP, 2015). It was one of regions of West Java Province and was committed to being independent by declaring its autonomy in the year of 2000. However, the FSC map only covers the regions in Banten Province and not the four cities located there. This implies that only 50% of the area is covered in the FSC map.

In this paper, food security status is analyzed not only in the regions, but also in the cities in Banten Province. The analysis which incorporates food security dimensions is based on Banten's Province population dynamics, population living in poverty, cereal production, baby malnutirion, risk of

disaster, and soil types. Banten's regions and cities are also grouped together in the three-dimensional plot of food security.

RESEARCH METHOD

This study involves descriptive quantitative research. Secondary data are employed from the Statistical Bureau and Planning and Regional Development Planning Bureau of Banten Province. Population dynamics, the population living in poverty, cereal production, and baby malnutrition data are taken from the Statistical Bureau. Meanwhile, disaster risk and soil type data are sourced from the Regional Development Planning Bureau. The six collected data sets consider three dimensions of food security and will be further discussed in the following paragraphs.

The first dimension is food availability, which indicates food supply (Rutten et al., 2011). It represents the production dimension (Patel et al., 2015) that usually refers to the calorie availability estimated by using normative consumption (FSC and WFP, 2015). The next dimension is food accessibility, which exhibits the individual ability to gain/ buy (Pannerselvam et al., 2010) or produce food. In other words, there is a close relation between poverty and food accessibility. The last dimension is food utilization, which shows balanced food nutrients to support an individual's health.

Food stability is also added to represent sustainable food access. The sustainable access period is essential as the status of food security can change within a short period of time. Changes may be caused by natural disasters (drought or floods), shifting supply and demand of food.

The data is analyzed descriptively. In the final analysis, three dimensions of food security (Table 1) are plotted to group the regions and cities in Banten Province.

Table 1. Food Security Dimensions

Food security dimension	Available variables
Availability	Cereal normative consumption
Accessibility	Population living in poverty
Utilization	Baby malnutrition

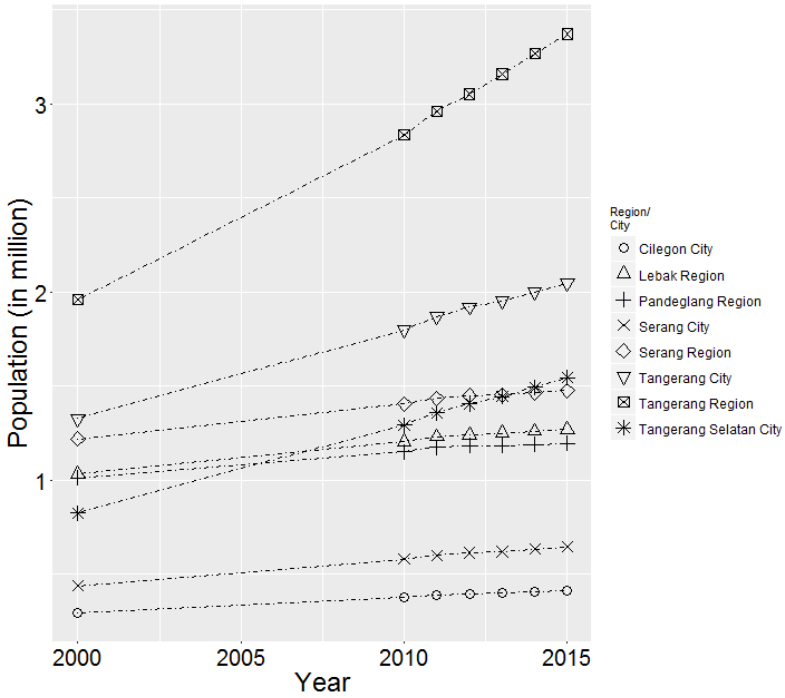
RESULTS AND DISCUSSION

Banten Province is administratively divided into eight parts, which are classified into four regions (Lebak, Pandeglang, Serang, and Tangerang) and four cities (Cilegon, Serang, Tangerang, and Tangerang Selatan). The scope of our paper for these eight areas are: population dynamics, population living in poverty, cereal production, risk of disaster, and soil types.

Population Dynamic

The total population of Banten Province in 2015 was 11.96 million people (BPS, 2016). The average annual population growth rate from 2010 to 2015 is 2.37%. Assuming this population growth rate of 2.37% to be constant, the total population in 2020 is estimated by using geometric series formula to be 13.44 million people. This is equal to 1.49 million additional people over five years.

To investigate the contribution of each region/ city to the total population, the population of each region/ city is plotted. Figure 1 shows that Tangerang Region and Tangerang City are the two areas which contribute the most to the total population. Along with Tangerang Selatan City, these three areas have steeper slopes than the others, indicating that they have a higher population growth rate. As an additional note, these areas are neighbors suggesting that they are the most vulnerable in terms of food security based on the food availability dimension due to the population giving a negative effect in the food availability (FSC and WFP, 2015).



Source: BPS (2011, 2012, 2013, 2014, 2015, 2016)

Figure 1: Population dynamic of the regions/ cities of Banten Province

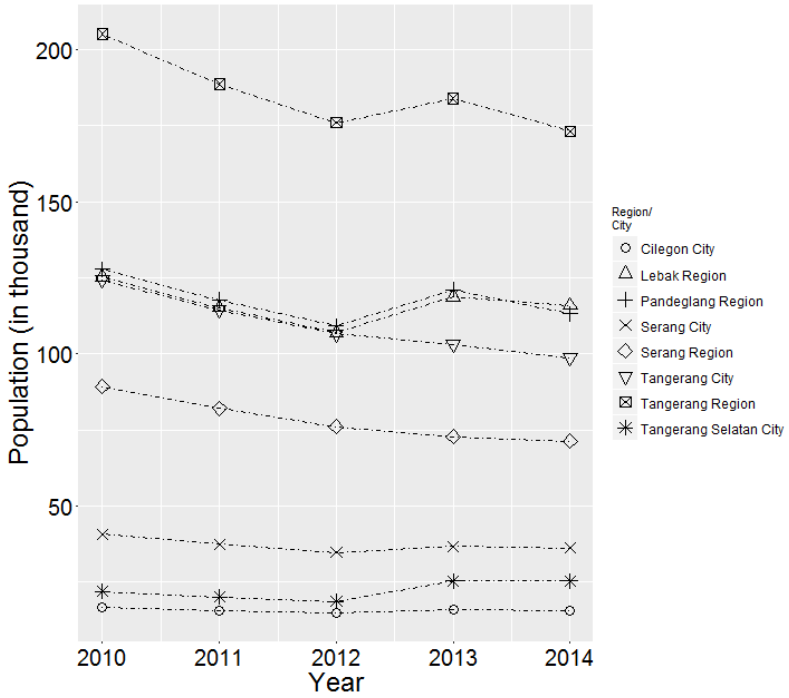
Population Living in Poverty

The measurement of poverty in this study is based on income per capita released by the Statistical Bureau of Indonesia. The poverty baseline was specific to particular area and semester. In 2014, the total population living in poverty in Banten Province was 649.25 thousand people (5.5% of the total population in 2014). The trend in poverty growth from 2010 to 2014 was negative, followed by a decrease in the number of people living in poverty. The average poverty growth is -3.4%.

The largest population living in poverty can be found in Tangerang Region (Figure 2), contributing one third of the total population living in poverty. This is followed by Lebak Region, Pandeglang Region, and Tangerang City. While overall, the areas show a decreasing trend regarding the population living in poverty, Lebak Region, Pandeglang Region, and Tangerang Selatan City show the opposite trend. Thus, these areas are the most vulnerable in relation to the food access dimension.

Cereal Production

To measure the food availability dimension of food security, a normative consumption index as an indicator representing calorie availability is required. The normative consumption index consists of two parts: population and cereal production. The previous section discussed population dynamics, while cereal production incorporates four important commodities, namely rice, maize, cassava, and sweet potato. The details are discussed in the following section.



Source: BPS (2011, 2012, 2013, 2014, 2015)

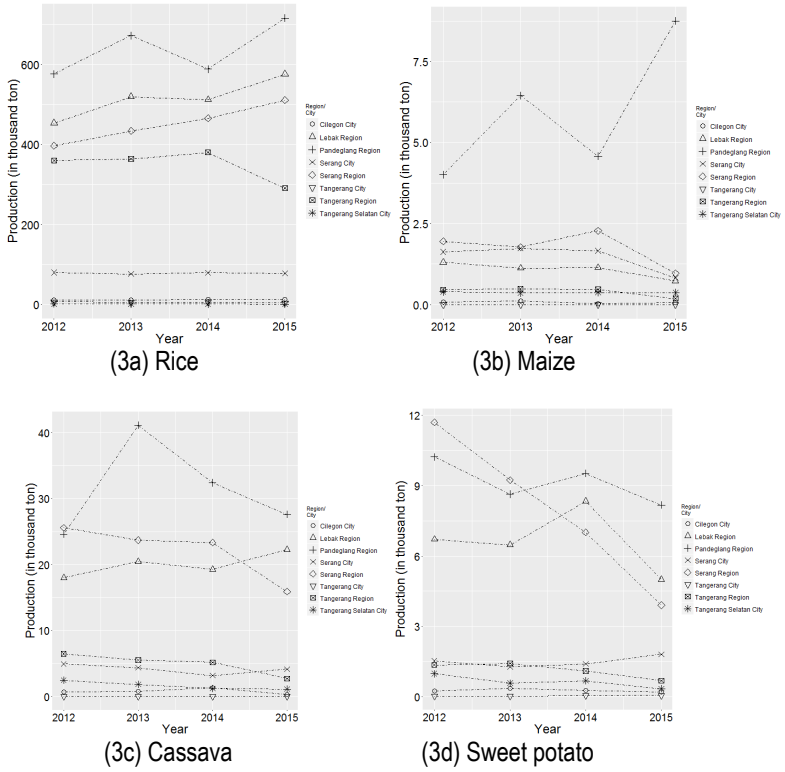
Figure 2: Population living in poverty

In total, Banten Province produced 2.19 million tons of rice in 2015. The average annual growth rate for this commodity is 5.22%. Although it has a positive growth rate, the major area which contributes the most is Pangdeglang Region (Figure 3a). Figure 3a shows that Pandeglang Region, Lebak Region, Serang Region, and Tangerang Region dominate rice production. The cities, on the other hand, produce small amounts of rice compared to the regions. Serang Region and Lebak Region are the only areas that show an increasing trend in rice production.

The total maize production of Banten Province in 2015 was 11.9 thousand tons. In terms of individual areas, most production comes from Pandeglang Region, which contributed over 70% to the total production in 2015 (Figure 3b). While the other areas show declining trends, the trend in Pandeglang Region is fluctuating. However, its production is always above 4 thousand tons.

Banten Province produced 74 thousand tons of cassava in 2015. Compared to rice and maize, cassava shows the opposite growth rate of -2.56%. Pandeglang Region, Lebak Region, and Serang Region are the major areas involved in cassava production (Figure 3c). All regions/ cities showed a decrease in cassava production, except for Lebak Region.

The last commodity to be discussed is sweet potato. In the context of cereal production in Banten Province in 2015, sweet potato accounted for the smallest share at 20 thousand tons. The overall production trend was the worst one compared to the other comodities, where there was a decline in production by as much as 14.06% on average. Serang Region suffered the highest fall, with its production reduced by more than a half over the four-year period (Figure 3d). Figure 3d shows that although the three regions of Pandeglang, Lebak, and Serang show a decreasing trend in sweet potato production, they still produced more than the other areas.



Source: BPS (2013, 2014, 2015, 2016)

Figure 3: Cereal production

For all commodities, the regions dominate cereal production compared to the cities. It appears that production is highly correlated with area size. Lebak Region, Pandeglang Region, Serang Region, and Tangerang Region, for instance, cover 35%, 28%, 18%, and 10% of the total area of Banten Province, respectively. The other four cities occupy the rest of the area, only accounting for 9%. Thus, to make proper comparison between the areas, cereal production was weighted by population size which yielded the normative consumption.

Risk of Disaster

The major disaster risk in Banten Province is erosion / landslide (Bapeda, 2010). The two regions suffering from erosion risk are Lebak Region and Pandelgang Region (Table 2). The second threat is flooding, which covers to almost all of the regions/ cities. As Serang Region, Tangerang Region, and Serang City are major rice producers, flooding is a great concern. These three areas produce less maize compared to Pandeglang Region (Figure 3b) as well. Irawan (2003) has explained that among cereal commodities, maize production is the most vulnerable and least able to cope with climatic anomalies, including flooding.

Table 2. Disaster risk summary

Region/ City	Accident risk
Lebak Region	Erosion/ landslide (major), flood (minor)
Pandeglang Region	Erosion/ landslide (major), flood and tsunami (minor)
Serang Region	Mountain eruption, flood, and tsunami (minor)
Tangerang Region	Flood (major), tsunami (minor)
Serang City	Flood and tsunami (minor)
Cilegon City	Mountain eruption (major), flood (minor)
Tangerang City	Flood (minor)
Tangerang Selatan City	-

Source: Adapted from Bapeda (2010)

Soil types

The most common types of soil in Indonesia are inceptisols and ultisols (Shofiyati et al., 2010). Similarly, latosol (inceptisols) and podsolik (ultisols) are also the major soil types in Banten Province. They are distributed over all areas (Table 3). Thus, the major soil constraint is the high aluminum content in the latosol soil type. It results in smaller amounts of phosphorus in the soil so that plants cannot grow well. Applying fertilizer helps plants absorb phosphorus. Meanwhile, podsolik soil suffers greatly from erosion risk. A tillage strategy is important to reduce soil erosion in arable land.

Table 3. Soil type summary

Region/ City	Soil type
Lebak Region	Latosol and podsolik (major), rensina (minor)
Pandeglang Region	Latosol, podsolik, alluvial (major)
Serang Region	Latosol, podsolik, alluvial, glei (major)
Tangerang Region	Latosol, podsolik, alluvial, glei (major)
Serang City	Podsolik, alluvial, glei (major), regosol (minor)
Cilegon City	Latosol (major), regosol and alluvial (minor)
Tangerang City	Latosol (major)
Tangerang Selatan City	Latosol (major)

Source: Adapted from Bapeda (2010)

Three Dimensions of Food Security

After presenting the population dynamics, the population living in poverty, cereal production, disaster risk, and soil types, three dimensions of food security is required to locate the distribution of the areas in Banten Province based on food security dimensions. The dimensions used are food availability, access, and utilization.

Normative consumption is one of food availability indicators, with the baseline for food security being 0.11 ton/ year. It is estimated by the sum of cereal productions divided by the number of total population. For cassava and sweet potato productions, they are weighted by factor 3 (FSC and WFP, 2015). Table 4 shows that Serang City, Cilegon City, and Tangerang Selatan City are all below the baseline. With very low normative consumption scores, they all have insecure food availability status.

The second dimension is food accessibility, which usually relates to poverty. A ratio between the number of prosperous people and the total number of people is calculated to obtain the food access indicator. This indicator shows that Tangerang Selatan City has the greatest access to food (Table 4).

The third dimension is food utilization, which indicates the proportion of normal babies, i.e babies without any undernourished case. This indicator portrays the health aspect. Table 4 shows that Tangerang Selatan City has the highest nutritition food balance (99.9%).

Table 4. Food security dimension score

Region/ City	Availability	Access	Utilization
Lebak Region	0.511	0.905	0.993
Pandeglang Region	0.415	0.908	0.994
Serang Region	0.117	0.947	0.997
Tangerang Region	0.327	0.951	0.991
Serang City	0.003 [a]	0.951	0.998
Cilegon City	0.032 [a]	0.962	0.995
Tangerang City	0.131	0.943	0.995
Tangerang Selatan City	0.001 [a]	0.983 [b]	0.999 [c]

[a] below availability base line, [b] widest food access, [c] highest nutririon balance
Source: Adapted from BPS (2014)

Finally, the three dimensions of food security are plotted. Figure 4 shows that there are two groups of regions/ cities. The first group consists of Lebak Region, Pandeglang Region, and Serang Region, while the other regions/ cities belong to the second group. With respect to FSC and WFP (2015), the results indicate that Lebak Region, Pandeglang Region, and Serang Region were more food insecure than Tangerang Region. Figure 4 indicates that Tangerang Selatan City, Tangerang City, Tangerang Region, Cilegon City, and Serang City are all food secure regions/ cities.

Figure 4 excludes the stability dimension, i.e. natural disasters. The food insecure areas share flooding as the common natural disaster threat. To monitor food security from all dimensions, the local government usually expects extension agents who are working within districts to report their findings continuously. Thus, we can analyze the food security into more detail areas such as districts instead of regions/ cities in future research.

Budiaji (2014) has discussed the food security analysis of Serang City in district level, yet all districts in Banten Province were still absent. When entire districts in Banten Province are included, food security area monitoring should not only cover three indicators for three dimensions but also other indicators related to food security dimensions. This extension might encounter a mixed class of indicator variables, i.e. numerical, binary, and categorical variables. An appropriate grouping (partitioning) analysis for this type of mixed variable should be taken into consideration as well.

CONCLUSION

In this paper, we extended food security analysis to not only involve the regions but also the cities in Banten Province. Tangerang Region had both the highest population and highest population living in poverty. Along with Tangerang Selatan City, it had a rapid growth population. With regard to cereal production, on the other hand, the regions dominated cereal production compared to the cities for all commodities and the cereal production were highly correlated to the size of the areas. For major rice producing areas such as Serang Region, Tangerang Region, and Serang City, flooding endangers their arable land. Finally, the food availability, access, and utilization indicator scores were plotted in order to discover the areas distribution in three-dimensional food security. The results show that three regions namely Lebak Region, Pandeglang Region, and Serang Region were located in a food insecure group. To monitor food security more practical and detail, it is advised to group districts and to apply suitable partitioning analysis due to encountering possible mixed variable indicators.

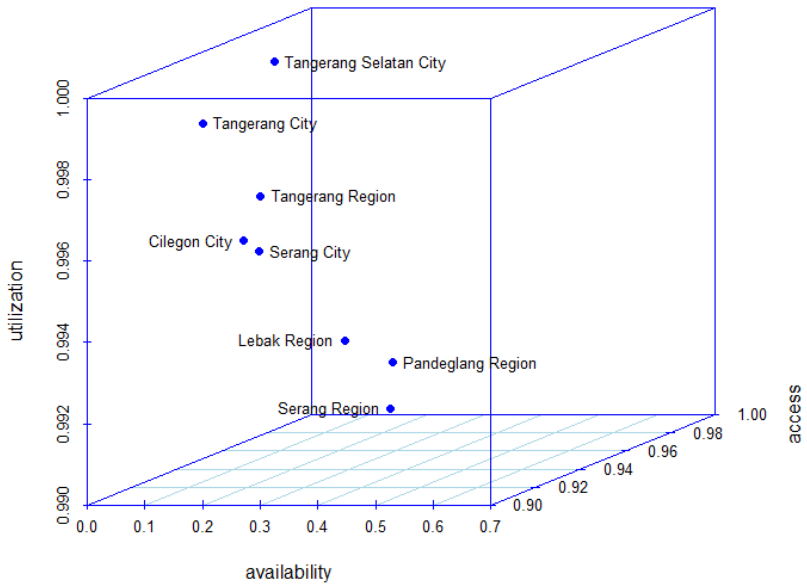


Figure 4: Regions/ cities of Banten Province three-dimensional distribution

ACKNOWLEDGEMENTS

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EVALUATION THE EFFICIENCY AND EFFECTIVENESS OF IRRIGATION NETWORK TO THE NEEDS OF WATER IN RICE PLANTS (*Oryza sativa*) OF BANTEN WETLAND

[1*)] Sri Ritawati, [1)] Nurmayulis, [1)] M.Adi Supriadi

[1)] Agroecotechnology Department, Faculty of Agriculture, University of Sultan Ageng Tirtayasa, Indonesia

[*)] Correspondence e-mail : s.ritawati@yahoo.com

Abstract

This research was aimed to evaluate the efficiency and effectiveness of irrigation network to the needs of water in rice plants (*Oryza sativa*) of Banten wetland. This research was conducted in the Irrigation area of Pasir Eurih, Cipeucang sub district, Pandeglang Regency, Banten Province of Indonesia from June until August 2015. This research was used descriptive method quantitative approach, which consists of an assessment or measurement conditions of climatology, hydrological analysis, also the condition of the irrigation channels. Plant growth parameters of rice (*Oryza sativa*) were observed consisting of plant high and number of tillers, also analysis the efficiency of irrigation canals, irrigation networks, the effectiveness and the need for water of rice plant. Research results were efficiency rate in the primary network amounted to 75.5 %, secondary network I 55.8 %, secondary chain II 61.2 % and tertiary networks amounted to 70.4 %. For the level of effectiveness in the secondary network I reached 46% and the level of effectiveness of the network at the secondary II of 89.6%. The needs of irrigation water of rice plant (*Oryza sativa*) for 1245 Ha area was 1661 l/sec, while the debit entry to the Weirs 1892 l/sec. The water supply would be enough, effected on the growth of rice plant in each growing stadia. In the secondary network II plant height 52.37 cm and number of tillers per clump rice 14.25 better than secondary network I.

Keywords: efficiency, effectiveness, irrigation water needs, rice plants

INTRODUCTION

Rice is one of the most important sources of carbohydrates in Indonesia. Rice (*Oryza sativa*) is a food crop that produces rice. Rice as a food crop is consume approximately 90 % of the total Indonesian population for staple food. The need for rice continues to increase as the increase in the number of consumers was not matched by adequate production. Maximum national production reaches only about 70.83 million tons/year (BPS, 2014).

Rice is the backbone of a rural economy cultivated by more than 18 million farmers, accounting for almost 70 % of gross domestic product of food crops, providing employment and income opportunities to over 21 million households with income contribution of around 25-35%. Rice production in 2014 (ASEM) was 70.83 million tons of dried unhulled rice (GKG) or decreased by 0.45 million tons (0.63 %) compared with 2013 (BPS, 2014). Limitations of rice production was not separated from the conditions of land management unfamiliarity and lack of awareness of efforts to utilize irrigation water effectively and efficiently.

A review of operational efficiency of irrigation channels to support the provision of national food was necessary, so that the availability of water in the land will be fulfilled even though the land is far from the surface water source. The contribution of infrastructure and irrigation facilities to food security has been considerable at 84 % of national rice production from irrigated areas (Ansori, 2012). To increase agricultural production in addition to improving the quality of seeds, fertilization, pest control, and plant diseases, it should also be noted the role of irrigation. Water utilization through Irrigation requires a good management system, so that water utilization can be implemented effectively and efficiently.

The Pasir Eurih irrigation area was a technical irrigation area, located between 106°10'00"-106°14'00" east longitude and 05°78'00"- 05°72'30" south latitude. While the city of Pandeglang, the

direction was in the south with a distance of approximately 12.00 km. The irrigation area irrigates rice fields of 1,245 ha was irrigated by taking (divide tap building, tap building) and complementary buildings already exist. Over the course of time many irrigation channels have been found damaged, whether they are lightly damaged, moderately damaged or heavily damaged, this may affect the distribution of water from the weir to the patches, and will ultimately decrease the planned extent of the planned area by 1245 Ha. Therefore, it was necessary to evaluate the irrigation network in order to find out how big the depreciation of the area of rice fields irrigated by the Pasir Eurih irrigation weir.

This research was aimed to evaluate the efficiency and effectiveness of Pasir Eurih irrigation network to the needs of water in rice plants (*Oryza sativa*) of wetland.

RESEARCH METHOD

This research has been carried out in the area of Pasir Eurih District irrigation Cipeucang, Pandeglang District, Banten Province, in June-August 2015. The tools used in this research were meter, documentation tool, stationery, raffia strap, ping pong ball and irrigation technical book. The materials used in this research are supporting secondary data, among others, rainfall data in Pasir Eurih irrigation area, temperature and humidity, solar irradiation, evaporation, evapotranspiration data in the area of Pasir Eurih irrigation, previous debit measurement data in Pasir Eurih irrigation area, and data on cropping pattern and group system in Cipeucang Sub District, Pandeglang Regency.

This research used quantitative descriptive method approach, consisting of an assessment or measurement of climatological conditions, effective rainfall, average rainfall, rainfall, temperature, sunlight obtained from Station Climatology Taktakan, as well as technical data of irrigation networks, and irrigation area, irrigation structure, irrigation channel measurement, water debit, calculate irrigation channel dimension, calculate effectivity and efficiency of irrigation channel, and hydrology analysis for rice water needs (*Oryza sativa*) such as calculating water requirement during land preparation, calculating water demand in rice field, calculating evapotranspiration, and establishing percolation rate, calculating irrigation water requirement and growth parameter of rice plant in the form of plant height and number of tillers. So that obtained information about condition of study area, then the data was analyzed so that can know the effectivity and efficiency of irrigation channel to growth of paddy rice field (*Oryza sativa*) at study location.

Data analysis performed include :

1. Describe the irrigation network include :
   a) Location and area of irrigation area (irrigation map).
   b) Irrigation building condition (field survey).
   c) Climate situation.
2. Establish points of location of irrigation channel measurement (irrigation map).
3. Data on cropping pattern and group system.
4. Calculate the water debit

Measurement of water discharge by using buoy method, where the measurement was done at the point location that has been determined.

Water discharge can be calculated by the formula :

$$Q = A \times V$$

Information:

V = volume of water (m^3) A = cross-sectional area Q = water discharge (m^3/s)

5. Calculate the dimensions of irrigation channels.
6. Hydrological analysis (average rainfall, reliable rainfall, and effective rainfall).
   Average rainfall calculation formula :

$d = 1/n (d1 + d2 + ... dn) = \Sigma di/n$ (Ansori, 2012)

Where :
d = rainfall average
d1 + d2 + ...dn = rainfall data at raindrop post 1, 2, ... n
n = number of rainfall data

Calculation formula of rainfall mainstay:

$$R80 = \frac{n + 1}{s} \quad \text{(for reliability of 80\%)}$$

Where :
R80 = precious rainfall for rice crops
n = number of rainfall data
The formula for effective rainfall calculation :

$$Re = \frac{R_{80} \times 0.70}{n}$$

7. Calculating evapotranspiration.

$$ETo = \frac{0.408\ \Delta\ (Rn - G) + \gamma \quad 900 \quad \frac{u_2\ (es - ea)}{T + 273}}{\Delta + \gamma\ (1 + 0.34\ u_2)}$$

information :
Eto = Evapotranspiration reference (mm / day),
Rn = Net radiation on the plant surface (MJ / m^2 / day),
G = Continuous heat density on soil (MJ / m^2 / day),
T = Average daily temperature at 2 m (^{o} C),
u_2 = Wind speed at 2 m (m/ s),
es = Saturated steam pressure (kPa),
ea = actual vapor pressure (kPa),
α = steam pressure curve (kPa / ^{o} C),
γ = Psychrometric constants (kPa / ^{o}C).

The magnitude of evapotranspiration was calculated using the Panmann method. Evapotranspiration was calculated using empirical theoretical formulas taking into account the associated meteorological factors such as air temperature, humidity, wind speed and the duration of solar irradiation. Evapotranspiration calculations were aided by using the Cropwat 8.0 FAO production application, the results of the calculations were presented in the table.

8. Set the rate of percolation
Using a 10 cm diameter pipe cylinder embedded in the paddy soil, then record the water level h1 at time t1 with the measuring ruler, hose 1 hour then record again the water level h2 at time t2 then convert the measurement result to 24 hours, so that the percolation rate was obtained for a period of one day.

$$P = \frac{h1 - h2}{t1 - t2} \ mm/day \qquad \textit{(Kodoatie J, 2010)}$$

Where :
P = percolation rate (mm / day)

h1-h2 = difference of water height in time cylinder t1 and t2 (mm)
t1-t2 = time difference of observation of water level in pipe (day)

Percolation was the absorption of water into the ground in a downward vertical direction. The magnitude of percolation was influenced by soil properties, groundwater depth and root system. The percolation coefficient was as follows :

a. Based on the slope
Flat field = 1 mm / day
Sloped land > 5% = 2-5 mm / day
b. Based on texture
Weight (clay) = 1-2 mm / day
Medium (clay powder) = 2-3 mm / day
Light weight = 3-6 mm / day

9. Calculating Irrigation Water Requirement for Rice Plant (*Oryza sativa*)
The irrigation water requirement was the amount of water that must be taken from the irrigation network to sufficient the water needs of the irrigation service area, in this case including the water lost during the journey to the area to be irrigated. Based on the standard Irrigation planning book designed by the Department of Public Works of the Directorate General of Watering, the need for irrigation water for rice crops (*Oryza sativa*) was divided into 2, namely:
a) Water requirements during Land Preparation.
b) Water Requirements for Rice Plants during the Growth Period.
c) Calculating water requirements during land preparation. (Ansori, 2012).

$$Ir = M\left(\frac{e^k}{e^k - 1}\right)$$

Where :
Ir = irrigation water requirement at paddy level (mm/ day)
M = the water requirement to replace the water lost by evaporation and the saturation in thesaturated fields
M = Eo + P
Eo = open water evaporation taken by 1.1 Eto during land preparation
Eto = potential evapotranspiration
P = percolation (mm / day)
K = M (T / S)
T = period of land preparation
S = water required for saturation plus 50 mm ie 200 + 50 = 250 mm
e = constants (2.71828)

Water Requirements for Rice Plants during the Growth Period

$$Q = \frac{C \times NFR}{e} \times A$$

By:
Q = discharge of irrigation water requirement (lt / dt)
C = coefficient of reduction due to the existence of group system (= 1)
NFR = Net Field Water Requirement (lt / dt / ha)
A = Area of the flowed area (ha)
e = channel efficiency

The discharge of irrigation water demand was the amount of water taken to sufficient the needs of the plant, including in the discharge of the lost water in transit.
NFR value obtained formula below :

NFR = ETc + P – Re + WLR

With :
NFR = Net Field Water Requirement (lt / dt / ha)
ETC = Water requirement for plant, mm / day.
P = Percolation, mm / day
Re = Effective Rain, mm / day
WLR = water layer replacement, mm / day

10. Calculate the efficiency of irrigation channels
    The formula for water loss at the time of disbursement was expressed as follows:
    $B = \frac{\text{inflow - outflow discharge x 100\%}}{\text{debit inflow}}$ (Ansori, 2012)
    Where :
    B = water loss during discharge
    Debit inflow = amount of water entering
    Outflow discharge = amount of water out
    Thus, the efficiency formula was expressed as follows:
    Ec = 100 % - B
    Where :
    Ec = efficiency of irrigation water distribution
    B = water loss during discharge

11. Calculate the effectiveness of irrigation networks
    $IA = \frac{\text{planted area x 100\%}}{\text{Wide design}}$
    In this case, the higher the value of IA (%) indicates the more effective the management of irrigation networks.

12. Parameters of growth of rice crops
    a. Plant height, Plant height was measured at the beginning of planting by measuring from the base of the stem to the end of the longest leaves (by unifying the whole leaf) using a meter (cm).
    b. Number of tillers, Number of tillers was calculated manually by observing, sorting and counting one by one the number of tillers of rice plants used as sample plants. Samples were taken from several villages that obtained water from the same secondary irrigation canal, taking into account the same varieties of rice crops and simultaneous planting periods. Rice growth data were then analyzed graphically.

The first week was used to collect secondary data supporting this research, among others, rainfall data in Pasir Eurih irrigation area, temperature and humidity data, solar long irradiation, evaporation data, evapotranspiration data in the area Pasir Eurih irrigation, all of which are obtained from the Serang Banten Tidal Climatology Station. In addition, other secondary data was also needed in the form of the previous debit measurement data in the Pasir Eurih irrigation area, as a comparison material obtained from the UPT of the Public Works Department of Water Resources of Pandeglang Regency. And data of cropping pattern and group system in Cipeucang Sub District Pandeglang Regency obtained from Agriculture and Livestock Service of Banten Province. In the second week was used for the preparation of the tools used in the measurement of primary data. In the third week was

used to calculate the required primary data, among other things, calculate the discharge at a predetermined location point, calculate the dimensions of the irrigation channel, establish the percolation rate, calculate the water requirements during land preparation, calculate the water requirements in the rice field, calculate the channel efficiency irrigation, calculating irrigation water needs. Also calculating the height of rice plants at 1 week after planting (WAP), 2WAP, 3 WAP, 4 WAP, and 5 WAP and count the number of saplings starting at the moment the emergence of productive tillers on rice plants (*Oryza sativa*) are sampled.

The data obtained then analyzed used simple descriptive statistics in which descriptive statistics were the means of data collection and presentation of data so that it is easy to understand. Conclusions in descriptive statistics (if any) are only directed to existing data sets. Based on the scope of discussion descriptive statistics include: 1. Distribution of frequency and its parts such as : a. Distributed graph, b. Mean (mean value).

RESULTS AND DISCUSSION

Location and Area of Irrigation Area

The study took place in Pasir Eurih irrigation area from June 2015 to August 2015. The Pasir Eurih irrigation area was a technical irrigation area, located between 106°10'00"-106°14'00" East Longitude and 05°78'00"-05°72'30" South latitude. While from Pandeglang city, the direction was in the south with a distance of approximately 12.00 km.

The irrigation areas above irrigate rice fields of 1245 Ha, were irrigated areas with right intake. Main building (fixed weir) and retrieval building (divided and tapping building, tapping building) and complementary buildings.

Topography of the Pasir Eurih irrigation area has a small and relatively flat slope, stretching from north to south with altitude ranges 250 m above the mean sea level and 90 meters in the southern boundary of the irrigation area. Physically in the field, the Pasir Eurih irrigation area has boundaries, among others: the north was bordered by water drainage (Afvour), the east was Eurih Sand village, the south was bordered by the Cilemer river and Pandeglang-Labuan highway, and west bordering the Pandeglang-Labuan highway.

The main water source of the Pasir Eurih irrigation area was the Cilemer River which the mainstay for irrigating rice fields of 1245 Ha. The catchment area of the Cilemer River up to the location of the Pasir Eurih dam was 65.20 km^2 and the length of the river from upstream to the location of the weir was 17.20 km.

State of Building and Irrigation Channels

Irrigation network of Pasir Eurih consists of the main building in the form of a weir, auxiliary buildings in the form of mud pouch, tapping, for tapping, culverts, village bridges, bridges people, spillway, overflow, gutters, washing stairs. Irrigation buildings can be classified into two types, namely civil buildings and electrical mechanical buildings (doors). Pasir Eurih irrigation area has a channel length of 13,800 m, which was based on field surveys in this Eurih Sand irrigation area there are 2 main channels, namely 10.862 m Carrier Primary Channel, and 2,938 m Carrier Transmission Line. (Office of Water Resources and Settlements of Banten Province, 2014).

Climatic Condition

Climatic conditions Pandeglang Regency has a tropical climate, namely dry and rainy season, BMKG measurement results quoted by the Central Bureau of Statistics recorded air temperature in Pandeglang regency ranged from 22.5^{0}C - 27.9^{0}C. In coastal areas, air temperature can reach 22^{0}C - 32^{0}C, while at mountain areas ranged from 18^{0}C - 29^{0}C. Pandeglang district has rainfall between 2,000 - 4,000 mm per year with an average rainfall of 3,416 mm and has 177 days of average rain per year and has an average air pressure of 1,010 millibars. The climate in the Pandeglang District is influenced by the Monson Trade and La Nina or El Nino Waves (BPS, 2014). During the rainy season (November-

March) the weather was dominated by the West Wind (from the Indian Ocean to the South of India) that joins the wind from Asia passing through the South China Sea. In the dry season (June-August), the weather was dominated by East Wind which caused the Pandeglang Regency to suffer drought, especially in the northern region, especially if it goes on El Nino.

Measurement Location

Based on the survey results in the field obtained points of measurement sites to measure the flow of water in the irrigation channel, the measurement was done in the primary channel, in secondary channel I, secondary channel II and tertiary channel. Besides, there were also measurements of plant height and number of rice tillers (*Oryza sativa*) in the rice fields that were sampled. To further obtain the necessary data in support of this research. The location of the measurement can be seen from the image below :

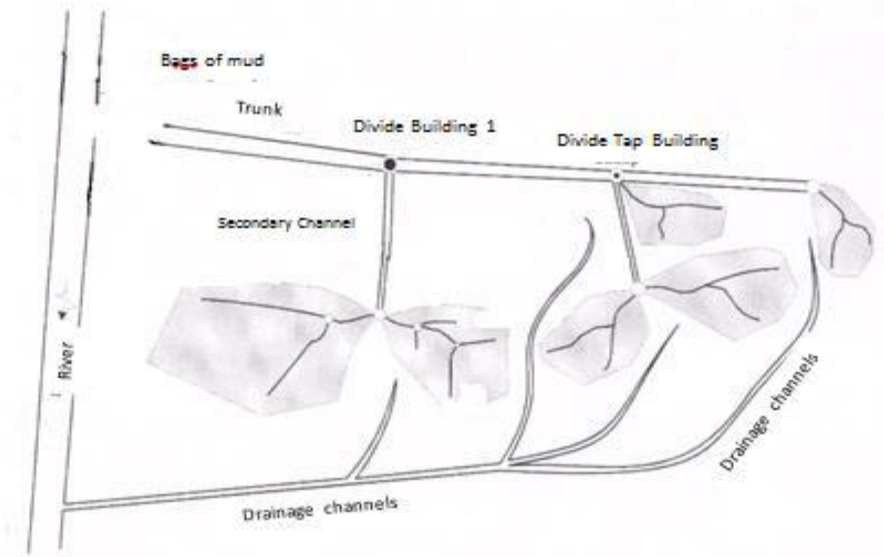

Figure 1 : Location of water debit measurements, plant height, and number of rice tillers.

From the figure above it was known that the measurement point of water debit in the primary, secondary, secondary and tertiary channels located in the village of Pasir Eurih, and the location of the rice fields to one and the second was also located in the village of Pasir Eurih. While the location of the third and fourth fields of rice fields in the Parigi village.

Data of Planting Pattern and Group System

For most irrigated agricultural areas in Pasir Eurih applied the rice-rice-palawija cultivation pattern. According to the sub-district in Pandeglang District where the Eurih sand irrigation rice area was located administratively in Cipeucang Sub-district, rice-rice-palawija cultivation pattern was very well applied, it was known if the land was planted continuously in three seasons of planting in one year, then the productivity of rice crops in the third season will decrease, and many pest attacks appear, for it was chosen that the cultivation of rice-palawija crops to keep the land productive for one year of planting. In the calculation of water balance, the need for the resulting yield for the cropping pattern used will be compared with the availability of water and the area that can be irrigated.

Measurement of Water Debit in Irrigation Channel

Based on the measurement results obtained value of the amount of water discharge entering in some irrigation networks presented in Table 1.

Table 1. Water Debit Measurement Results

No	Network	Water Debit (l/det)
1	Primary	1892
2	Secondary I	87
3	Secondary II	178
4	Tertiery	75

Source: Measurement results

From Table 1 above we can see the amount of water discharge for the primary channel level of 1892 l / s, the secondary channel I of 87 l / s, the secondary channel II of 178 l / s, and in the tertiary channel of 75 l / s. The magnitude of a water discharge value was influenced by rainfall occurring in the upper river, high rainfall intensity can increase the flow of the existing water flow, in addition the channel shape and resistance in irrigation channel also affect the value of water debit, rock bottom and muddy channel known can inhibit the flow of surface water through the channel, so that the optimum value of water debit that can be accommodated by the channel becomes reduced, consequently the area of irrigation water plan which originally 1245 Ha can shrink. Lack of water in the rice fields can affect the growth of the number of tillers of rice, it was known that the role of water was very important in the formation of tillers, it was known that in the growth process there were two factors that affected the growth, among others internal and external factors, water as an external factor in this case cofactor role for growth enzymes.

Dimension of Irrigation Channel

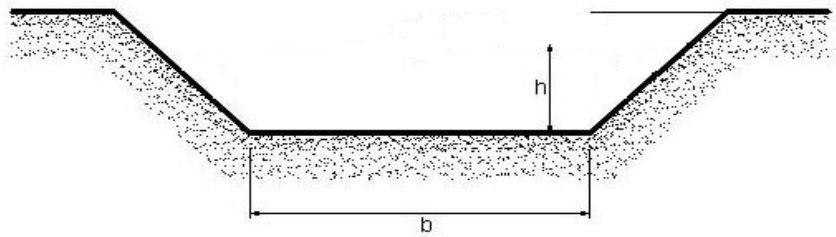

Figure 2 : Irrigation network scheme

Based on the survey results in the field showed most of the trapezoidal irrigation channels with different dimensions, it was known that for scale dimension in the weir channel of 10.6 m2 with channel length of 10,862 m2, for the dimension of channel in secondary channel I of equal to 0.9 m2, for the dimension of the channel in the secondary channel II of 3 m2 with length of secondary channel along 2,938 m2, for the dimension of channel in tertiary channel I of 0.8 m2.

Hydrological Analysis

Based on the calculation results obtained value of 220.5 mm/month for the average amount of rainfall area around Pandeglang and Serang areas.

Effective rainfall, was rain water that can entered and survived in the root zone, so useful for plant growth. In the calculation of the debit of irrigation water needs for effective rainfall factor, it was included as a negative factor, this means that if the effective value of rain was greater, the basic need for irrigation water in the rice field will also decrease, and vice versa if the value of rain was effective, the water base in the fields will increase. The results of effective rainfall analysis can be seen in Table 2.

From the calculation results obtained figure 3.12 mm / day for the planting period of rice in August, rainfall in this period was low. As it was known that high rainfall can affect the growth process of rice plants, because rice plants required hot weather for optimal growth. While low rainfall will disrupt the growth process was the number of tillers of rice, because the availability of adequate water will increase the growth of productive tillers, thus enlarging the production.

Table 2. Data of Effective Rainfall

No	Month	Effective Rainfall (mm)		
		R80	RE Rice = 0.7 x R80/15	RE land preparation = R80/15
1.	January	442	20,6	29,4
2.	February	210	9,8	14
3.	March	568	26,3	37,8
4.	April	334	15,5	22,2
5.	May	117	5,46	7,8
6.	June	52	2,42	3,4
7.	July	41	1,9	2,7
8.	August	67	3,12	4,4
9.	September	104	4,8	6,9
10.	October	88	4,1	5,8
11.	November	141	6,3	9,4
12.	December	298	13,9	19,8

Source: Analysis of Effective Rainfall

Percolation

The percolation rate for the Pasir Eurih irrigation area was 3mm / day, it was known from the percolation rate measurement using the pipe cylinder buried into the rice field soil and then measured the water depreciation level for approximately 24 hours, the calculation result was attached. Percolation rate was also strongly influenced by soil texture, for paddy soil texture at measuring site can be known sandy clay, with percolation rate about 3 mm / day. The texture of sandy loam soil was known not to be so impermeable to water that water easily enters the soil, otherwise the sand texture that can not bind water further accelerates the rate of water degradation into the soil.

Evapotranspiration

The rate of evapotranspiration in the Pasir Eurih irrigation area can be seen in Table 3. The rate of evapotranspiration in the planting period of rice in August of 4.61 mm / day or by 142.9 mm / month, this figure was quite large that in the August period of moderate rainfall was not too high and the temperature in the period of August was also quite high , this affected the rate of evapotranspiration on the growth of the plant. Required an adequate water supply to keep pace with the evapotranspiration rate for rice crops to be steadily growing at every stage of growth. The optimal irrigation water distribution was absolutely necessary, in order to compensate for the

evapotranspiration rate occurring during the growing stadia period, the high evapotranspiration rate will not have much effect if the optimal irrigation water supply goes to the irrigated paddy field.

Table 3. Evapotranspiration Calculation

No	Month	Evapotranspiration	
		(mm/day)	(mm/month)
1.	January	3,18	98,6
2.	February	4,07	114
3.	March	4,40	136,4
4.	April	3,87	116,1
5.	May	3,77	116,9
6.	June	2,89	86,7
7.	July	3,05	94,6
8.	August	4,61	142,9
9.	September	4,35	130,5
10.	October	4,64	143,8
11.	November	4,12	123,6
12.	December	3,49	108,2

Irrigation Network Efficiency

The efficiency of irrigation was the comparative number of the actual amount of irrigation water used for plant growth needs with the amount of water out of the intake door. Irrigation efficiency was the main determinant of performance of an irrigation network system. The efficiency of irrigation consists of the efficiency of drainage that generally occurs in the main network and efficiency in the secondary network, ie from the divider building to the rice field plot (Directorate General of Irrigation, 1986). Referring to the Directorate General of Irrigation (1986) the overall efficiency of irrigation was 90% and the tertiary level 80%. The overall irrigation efficiency figures were calculated by converting the efficiency at each level of 0.9 x 0.9 x 0.8 = 0.648 = 65%. The results of irrigation efficiency analysis can be seen in Table 4.

The loss of irrigation water from the tertiary tapping gate to the rice field was usually referred to as the efficiency of tertiary provision, whereas the loss of water from tapping the weir to tertiary tapping was expressed as the efficiency of water supply in the main tissues (Soetjipto, 1992). Several irrigation channels exist in an irrigation system as follows :

a. Primary channels carry water from tapping buildings to secondary channels and to irrigated tertiary plots. The end limit of the primary channel was the building for the latter.
b. Secondary channels carry water from tapping buildings from the primary canal to tertiary plots served by these secondary channels. The deadline of the secondary channel was the last tapping building.

c. The tertiary channel carries water from the intercepted building from the secondary channel to the quartz plots served by the secondary channel. The deadline of the secondary channel was the last tertiary box building.

Table 4. Irrigation Network Efficiency Data

No	Channel	Inflow (l/det)	Outflow (l/det)	Efficiency (%)
1.	Primary	1892 l/s	1589 l/s	75,5 %
2.	Secondary I	87 l/s	53 l/s	55,8 %
3.	SecondaryII	178 l/s	120 l/s	61,2 %
4.	Tertiary	75 l/s	67 l/s	70,4 %

Source: Analysis results

Based on the observations and after calculation, the data obtained on the average channel of Qin equal to 1892 l / s, and Qout of 1589 l / s. Secondary channel I obtained Qin data of 87 l / s and at Qout of 53 l / s, Qin II secondary channel of 178 l / s and at Qout of 120 l / s, while in tertiary channels obtained Qin data of 75 l / s and Qout of 67 l / s. Based on the calculation of the above debit can be calculated the efficiency of each irrigation channel. Primary channel efficiency was 75,5%, secondary channel I was 55,8%, secondary channel II was 61,2%, meanwhile efficiency of tertiary channel was 70,4%. This was due to the large area or width of the primary channel compared to the tertiary and secondary channels, resulting in the largest water discharge produced in the primary canal. But the efficiency was greatest in tertiary channels. The tertiary channel has a smaller irrigation channel size and slower current, which makes tertiary channel management easier and ultimately causes the water in tertiary channels to become more efficient. Calculation of the value of the efficiency of irrigation networks was very important, to find out how much water losses that occur due to seepage. P was known to reduced the amount of water discharge flowing from the dam door to the paddy fields. In addition, maintenance was needed along the irrigation canal, either cleaning of waste material, sedimentation of mud and fallen trees, to smooth the flow of water, so that the flow of water that can enter the irrigated fields is the most optimal water discharge. In this case, there needs to be awareness of each farmer group in the area of irrigated Pasir Eurih rice field, to always maintain the asset of irrigation building, so that the existing building was still in good condition, this certainly has an impact on the productivity level of the rice harvest itself.

Damaged irrigation building can certainly result in water loss from seepage, this is in accordance with the results of the survey of Water Resources and Settlement Office of Banten Province where based on survey results in the field conditions of irrigation channels in Pasir Eurih irrigation area in good condition of 46.42%, damaged light weight of 51.20%, moderate damage of 2.38%, and heavily damaged by 0.00%.

From Figure 3 above, it can be seen that the characteristics of irrigation channels were inhibited by the waste material, which inevitably impedes the flow rate of water entering the channel. As a result the available discharge becomes reduced and can affect the efficiency of the irrigation channel.

Figure 3 : Secondary II irrigation channels

Effectiveness of Irrigation Network

The effectiveness of irrigation network management was demonstrated by the ratio of area between the total area of the irrigation to the design area. In this case the higher the comparison the more effective the management of irrigation networks. The increase in the index of area (IA) in addition to the addition of new rice fields, can also mean that irrigation was managed effectively able to irrigate rice fields as expected.

It was known that the value of effectiveness depends on the availability of adequate infrastructure facilities and infrastructure, the length of the irrigation channel was very influential on the range of irrigation water that can be channeled to the rice fields in the Pasir Eurih irrigation area. Some of the irrigation canals in secondary plot II have improved and added channel length.

Figure 4 : Improvement of irrigation channels in secondary II

The improvement and addition of irrigation channel lengths are carried out by the community in Parigi village, with funding from the Public Works Department of Irrigation Pandeglang Regency, through the relevant village head, to be socialized to the community.

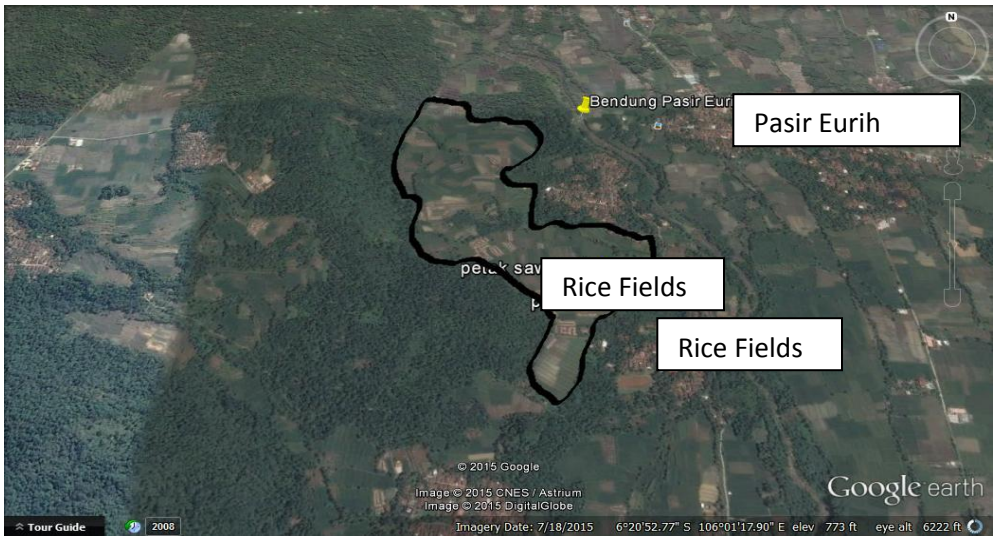

Figure 5 : Wetland area in secondary plot I

Based on the observations in the first secondary rice field I found the total area of rice fields of 9.2 Ha (design area), this result obtained with incorporates the coordinates of the rice field area to the calculating machine which in this case was assisted by earthpoint. Us, to then be analyzed, to obtain the number 9.2 Ha for the width of the rice field area in the secondary plot I. As for the area of rice fields irrigated by secondary network I of 4.3 Ha. The level of effectiveness of secondary network I obtained a value of 46%, this value was obtained by dividing the area of the irrigated area with the extent of the design to be multiplied 100%. This value was small, for the level of effectiveness of the irrigation network, since less than 50 percent of the area of the secondary plot I need additional irrigation networks to increase the effectiveness of irrigation networks in the area. Most of the rice fields that do not get the water flow from secondary network I get replacement water supply from Cikareo spring. Meanwhile, for the level of effectiveness in secondary network II of 89.6%. This figure was quite large, because most of the area of 125 Ha rice field, which was in secondary network II, get water supply from secondary network II. Rice crops are plants that require a lot of water, especially when they grow should always be inundated with water. In order for the productivity of rice to be effective in one unit of land area, it was necessary to supply enough water through irrigation. Irrigation was an infrastructure to increased the productivity of land and increased the intensity of harvest per year. The availability of sufficiently controlled irrigation water was an input to increase rice production. Given the importance of irrigation, the government's policy on irrigation development should be followed by the expansion of irrigation networks. Construction and rehabilitation of irrigation networks needs to be improved to maintain the proper functioning of water sources and irrigation networks for agriculture. In an effort to increase development in the agricultural sector to meet the food needs, especially rice, one of the efforts of the Indonesian government was to put development in the irrigation sector.

Irrigation Water Requirement for Rice Plant (*Oryza sativa*)

The crop water requirement was defined as the amount of water required by plants during a period to grow and produce normally. Real water requirements for agricultural business areas include evapotranspiration (ET), the amount of water needed for special operations such as land preparation and water replacement, and loss during use (Sudjarwadi, 1990).

From the calculation of water requirement in paddy field during processing and growth period of paddy, obtained figure (NFR) equal to 3,71 mm/day, then can be calculated water requirement at intake door at Pasir Eurih dam. The data required for calculating the irrigation water demand discharge

at Pasir Eurih dam was the area of irrigation area, the value of channel efficiency on the primary channel, and the value (NFR) of irrigation water needs for rice plants (*Oryza sativa*). Calculation of irrigation water demand with data:

1. Area of plan was (A) 1245 Ha
2. Efficiency on the primary channel (e) = 75.5% = 0.75
3. Irrigation system does not use class, so the value c = 1
4. The value of irrigation water needs for rice plants (*Oryza sativa*) (NFR) of 3.71 mm / day

Calculating the need of irrigation water discharge of Pasir Eurih Weir :
The calculation of the discharge requirement was calculated using the formula :

$$Q = \frac{NFR \ X \ A}{e \ x \ 3{,}71}$$

$$= \frac{1 \ x \ 3{,}71 \ x \ 1245}{0{,}75 \ x \ 3{,}71}$$

$$= 1661 \text{ l/s}$$

From the above calculation it can be seen that the water debit at the gate required to sufficient the needs of irrigation water for rice (*Oryza sativa*) was 1661 l / s. Meanwhile, based on the result of the calculation of the discharge done for the calculation of the efficiency of irrigation channel presented in Table 4, the amount of water discharge entering was 1892 l / s. Thus the amount of irrigation water demand for rice crops (*Oryza sativa*) in Pasir Eurih can still be fulfilled by Pasir Eurih Weir. In the calculation of water balance, the need for the resulting yield for the cropping pattern used will be compared with the availability of water and the area that can be irrigated. If water availability was abundant then the area of irrigation project will be maximum.

Consumptive water needs were influenced by the type and age of the plant (plant growth rate). As the crop begins to grow, the value of consumptive water demand increased according to its growth and reaches maximum at the time of maximum vegetation growth. After reaching the maximum and lasting a few moments according to the type of plant, the value of consumptive water demand will decrease in line with seed maturation. The influence of plant character on the need with the plant factor (kc). The value of this plant growth coefficient depends on the type of crops grown. For the same type of plant also varies according to the variety. For example, rice with superior varieties of growing period was shorter than ordinary rice varieties.

Water Requirements During Land Preparation

The water requirement during the preparation of the land was a pre-paddy field work used to plant rice, so the land must be prepared first. Land preparation work was done to obtain good soil for rice cultivation, in order to obtain an efficient water use condition, the need for water during land preparation must be taken into account. Water requirements during land preparation were presented in Table 5.

Water requirements for land preparation generally determine the need for irrigation water on an irrigation project. Important factors that determine the magnitude of water demand for land preparation were : A. The length of time required to complete the land preparation work ; B. The amount of water needed for land preparation. Meanwhile, the important factors that determine the length of the land preparation period are : second field rice, the availability of labor and cattle advocates or tractors to work on the land. Based on the calculation results, at least water required of 9.1 mm/day for more or less 30 days for the tillage of each plot of land in the village of Pasir Eurih. Most of the farmers in Pasir Eurih village cultivate their own rice fields using the help of livestock, this was what makes the land processing becomes longer due to constrained labor. Little was known to

use the services of hand tractors, because the cost of renting a tractor was pretty expensive. There were also farmers who cultivated their own rice fields using only simple tools namely hoes.

Table 5. Water requirements during land preparation

No.	M 1,1xEto + P (mm/day)	T = 30 day		T = 45 day	
		S = 250 mm	S = 300mm	S = 250mm	S = 300mm
1.	6,0	11,7	13,3	9,1	10,1
2.	6,5	12,0	13,6	9,4	10,4
3.	7,0	12,3	13,9	9,8	10,8
4.	7,5	12,6	14,2	10,1	11,1
5.	8,0	13,0	14,5	10,5	11,4
6.	8,5	13,3	14,8	10,8	11,8
7.	9,0	13,6	15,2	11,2	12,1
8.	9,5	14,0	15,5	11,6	12,5
9.	10,0	14,3	15,8	12,0	12,9
10.	10,5	14,7	16,2	12,4	13,2
11.	11,0	15,0	16,5	12,8	13,6

Source : Directorat general of irrigation, Program Foster 010,1986

Lack of manpower and capital, making the processing period of the land more severe and longer, this also affects the consumptive period of water use that should be allocated for other purposes in the area. It takes the role of the government in this case the Department of Agriculture and Livestock of Pandeglang Regency, to distribute the aid of hand tractors to each farmer group in the area of irrigated Pasir Eurih rice fields to be used interchangeably, in order to facilitate the farmers and certainly reduce the period of soil processing, the water needed for the tillage becomes less, and can be allocated to other needs, and certainly can increased the range of water-floodable areas of the Pasir Eurih dam.

Irrigation Water Requirement During Planting Period

The water requirement for the plant depends on the crop varieties and the growth period until harvested so as to provide optimum production. The approximate amount of water for irrigation was based on factors of plant species, type of soil, method of watering, soil management, rainfall, planting time, climate, channel / building maintenance and exploitation. The crop water requirement was defined as the amount of water required by plants during a period to grow and produce normally.

The use of water for the needs of plants (*consumtive use*) can be approximated by calculating the evapotranspiration of plants, which was influenced by the type of plant, the age of plants and climatological factors. The value of evapotranspiration was the sum of evaporation and transpiration. Evaporation was the process of changing water molecules on the surface into water molecules in the atmosphere. While transpiration was a natural physiological process in plants, where water exploited by roots passed through the body of plants and evaporated back through the buds. Evapotranspiration values can be obtained by field measurements or by empirical formulas. For the purposes of calculating irrigation water demand, a potential evapotranspiration value (Eto) was evapotranspiration

that occurs when sufficient water was available. From the calculation of water needs of rice plants (*Oryza sativa*) during the growth period, obtained figure of 3.71 mm / day.

Height of Rice Plant (*Oryza sativa*)

Growth and development was the process of increasing the size, shape and volume that was accompanied by the process towards maturity. Plant growth can be defined as a biological change event occurring in plants in the form of changes in size, shape and volume that are irreversible (not changing back to origin) and running simultaneously. While the development of plants was a process toward achieving maturity or a more perfect level that was characterized by the appearance of the organs of breeding. High plants and number of IR 64 varieties of rice seedlings were presented in Figure 6.

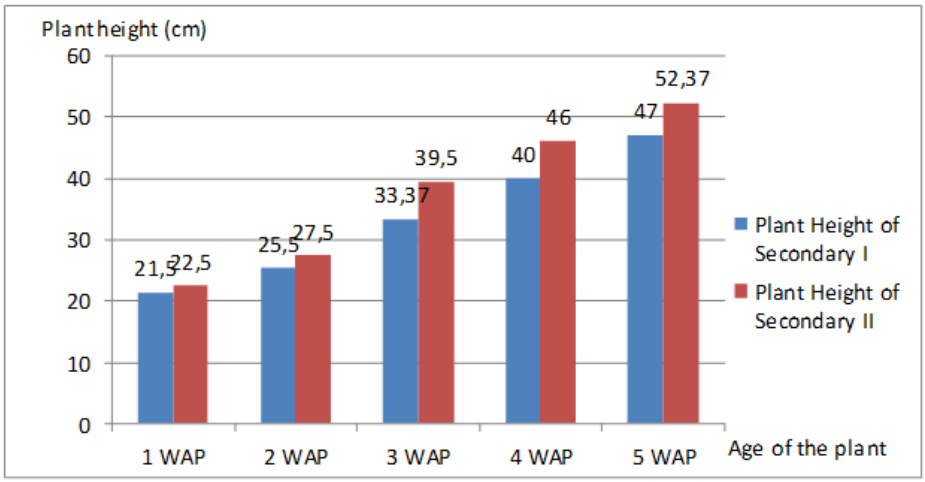

Figure 6 : Graph of rice plant height (*Oryza sativa*)

From Figure 6 above can be seen that the height of the plant has increased every week, from the four rice fields observed, obtained average height for rice plants (*Oryza sativa*). From the graph above it can be seen that the average of the best plant height was in the paddy fields in the secondary plot II (TP2). It was known that the water supply for the growth of rice crop (*Oryza sativa*) in secondary plot II was more adequate, as much as 67 l / s of water entering the tertiary rice plant rice fields (*Oryza sativa*). In addition to fertilizer factors, water was known to play a role in the process of growth in rice plants, it was known that water was a cofactor for growth enzymes. Lack of water supply was known to inhibit the growth process, this was similar to the results of research (Salisbury and Ross, 1992). Water deficiency affects all aspects of plant growth, which includes physiology, biochemistry, anatomy and morphology. At the time of lack of water, some leaf stomata closes so that the obstacles of entry of CO_2 and decrease photosynthesis activity. In addition to inhibiting the activity of photosynthesis, water shortages also inhibit protein synthesis and cell walls. Plants with water shortages generally have smaller size compared to normal growing plants (Kurniasari *et al*., 2010). While (Levitt, 1980, Bray, 1997), said that Drought stress was a term to state that the plant was experiencing water shortages due to water limitations from the environment that was planting media. Drought stresses in plants may be caused by a lack of water supply in the root zone and excessive water demand by leaves due to the rate of evapotranspiration that exceeds the water absorption rate even though the groundwater conditions were sufficiently available.

Tillers Number of Rice Clumps (*Oryza sativa*)

Rice plants form clumps with their tillers. Usually, the seedlings will grow on the base of the stem. The formation of the tillers occurs in stages, namely the first tillers, the second tillers, the third tillers, and the next tillers. The number of tillers of rice cultivation (*Oryza sativa*) was presented in Figure 7.

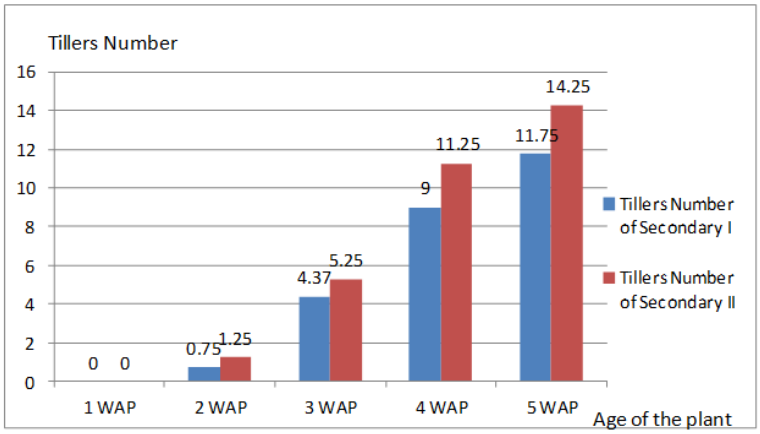

Figure 7 : Graph of number of tiller of rice cultivation (*Oryza sativa*)

From Figure 7 above it was known that the number of tillers of rice cultivation in Secondary plot II was better than secondary I, it was known that secondary plot II, more get water supply as much as 67l / s. While the secondary plot I was only 53 l / s. The efficiency of the irrigation network. Besides, there were other factors that can affect the number of tillers of rice cultivation, among others spacing, planting season, fertilizer. The wide plant spacing, supported by enabling environments, including soil fertility, will cause the plant to increase the number of seedlings, but too wide the distance will decrease the number of tillers per square. It was known that IR 64 varieties can have productive tillers up to 25 rods, can be seen from attachment 9. Number of tillers closely associated with plant spacing, the ideal plant spacing to get the many tillers was 25cm x 25cm, this spacing used in SRI farming method (system of rice intensification), but the reality in the field, farmers in the Pasir Eurih irrigation area still use the conventional spacing was 15cm x 15 cm. According to research (Muyassir, 2012) the production of grain per hectare shows a significant difference between plant spacing of 20 cm x 20 cm (7,76 t ha^{-1}) and 25 x 25 cm (7,68 t ha^{-1}) with spacing 30 x3 0 cm (8,12 t ha-1). This indicates that the tight spacing tends to suppress the production of paddy rice and plant spacing of up to 30 x 30 cm can produce the highest grain compared to other spacing. The rice yield was closely related to the number of tillers, and the number of optimum tillers can be obtained by using the ideal plant spacing, in this case 25 cm x 25 cm plant spacing can be applied to farmers in the Pasir Eurih irrigation area.

CONCLUSION

1. on the results of analysis and discussion, in this study can be concluded that: The channel efficiency level in the primary network was 75.5%, secondary I 55.8%, Secondary II 61.2%, and tertiary 70.4%, damage, waste, and sedimentation affect the value of efficiency.
2. Level of effectiveness in the secondary network area I was 46%, while for the level of effectiveness in the secondary network II area 89.6%. The level of water coverage affects the value of network effectiveness.
3. Water entering the dam of Pasir Eurih was 1892 l/s, still sufficient with the needs of irrigation water of rice crop 1245 Ha area of 1661 l/s.

4. Sufficient supply of water affects the height and number of tillers per clump of rice plant (*Oryza sativa*). Plant height 52.37 cm and number of tillers per clump rice plants 14.25 in secondary network II better than secondary network I.

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GRAIN CHARACTERISTICS OF COMMON RICE VARIETIES IN INDONESIA

[1*)] Siti Dewi Indrasari, [2)] Shinta Dewi Ardhiyanti, [1)] Titiek F. Djaafar

[1)] Assessment Institute for Agricultural Technology of Yogyakarta, Indonesia
[2)] Indonesian Center for Rice Research (ICRR), Indonesia

*) Correspondence email : dewindrasari@yahoo.com

Abstract

The objective of this research was to study the grain characteristics of several local and new superior varieties. The physical quality of paddy and the milling quality of milled rice were classified based on Indonesian National Standard (INS) No.0224-1987/SPI-TAN/01/01/1993 and INS No. 6128:2008. Out of 12 varieties, Local Black Rice, Mentikwangi, Inpari 1, and Inpari 6 had the best quality based on head rice percentage and milled rice yield. The head rice percentage for Local Black Rice and Mentikwangi had fulfilled for class II, while Inpari 1 and Inpari 6 had fulfilled for class I INS No. 6128:2008. Local Black Rice and Mentikwangi were grouped to varieties that had intermediate amylose, intermediate gelatinization temperature, and soft gel consistency. Inpari 1 was classified to varieties that had intermediate amylose, high gelatinization temperature, and soft gel consistency. Inpari 6 was included to varieties that had intermediate amylose, low gelatinization temperature, and soft gel consistency.

Keywords : physical quality, milling quality, physicochemical characteristic, local varieties, new superior varieties

INTRODUCTION

In average the new improved rice varieties released by Indonesain Agency for Agricultural Research and Development (IAARD) have high productivity. In addition to high productivity, rice quality is one factor that must be considered. Characteristics of rice are properties that are carried and displayed physically and chemically and play a role in shaping the quality of rice. Character of rice quality consist of physical quality, milling quality, physicochemical properties, nutrient quality and functional quality.

Damardjati (1995) classified the quality of rice into: 1) physical quality and milling quality, 2) flavor and cooking quality, and 3) nutrient quality. In general, the characteristics of rice quality are influenced by four main factors, namely: 1) genetic characteristics, 2) environmental and pre-harvest activities, 3) harvest treatment, and 4) post-harvest treatment. Each of these factors influences the characteristics of rice quality both dominantly and interactively as for the cooking and flavour quality the rice is determined primarily by the genetic properties of the paddy and little influence by the storage.

The physical quality of rice is reflected on the size and shape of rice which is the basic criterion in determining the quality of rice. In the world market, it is generally classified over very long grains (> 7mm), long (6.0-6.9 mm), medium (5.0-5.9 mm) and short (<5.0 mm). While the shape of rice is divided into 3 types depending on the ratio of length and width of rice (P / L ratio), oval (> 3), medium (2-3), and round (<2) (Juliano, 1993). In the international market long-sized rice has a high preference. Generally, long grain rice has a price of 15-20% above medium grains. Indians also like long grains, otherwise Asian subtropical population (Japan, Korea and Taiwan) prefer short round grains (Khush *et al*., 1979).

The quality of milled rice is reflected in the percentage of broken grains or head rice. In international markets, low fracture grains get a much better price than high broken grain content. In

Indonesia, the effect of broken grains and degrees on the price is relatively low, except for the premium-quality type of rice. In the Indonesian National Standard (SNI) for paddy and milled rice, moisture content is one of the important criteria. Moisture content of rice in all grades of quality should not exceed 14% (BPS 1993, 2008).

The cooking and eating value is determined by the amylose content and gelatinization temperature. The cooking and eating characteristics of rice is the base choice for the consumers. The amylose content is great determinant of rice cooking and eating characteristics (Asghar *et al*., 2012).

Information on the physical, milled and physical properties of rice is very much needed and is still limited. Moreover, it can be utilized as basic data of character of genetic resources on assembling of new superior varieties by rice breeders. Also can be used as a description information for farmers and rice producers who prefer the type of rice that is high production, high yield, and good rice quality. The quality of rice is also one of the factors that consumers consider in terms of buying rice. Besides rice quality is also one of the determinants of rice prices. Therefore, this study aims to study the physical, milling quality and physicochemical properties of common rice varieties in Indonesia.

RESEARCH METHOD

Material

The materials used are some of aromatic rice that is Situ Patenggang, Hipa 5 Ceva, Pandanwangi, Rojolele, Mentikwangi, Hipa 8 and some non aromatic rice that is Inpari 1, Inpara 4, Inpari 6, Inpara 3, Ciherang, and Subang Local Black Rice. New high yield grain samples were obtained from Seed Production Unit Source, Sukamandi Experimental Garden, Muara and Pusakegara as well as local grain varieties obtained from farmers.

Analysis Method

Grain is milled with Rice Husker Machine (Satake), and the yield of brown rice (BR) is expressed as weight percent of grain. Brown rice were milled for 3 minutes to get milled rice with 80-90% degrees. The yield of milled rice is expressed as percent to weight of grain. Rice heads, broken rice, groats, chalky grains, yellow and broken grains are manually separated and counted as percent to milled rice. The length and width of the rice is measured by a micrometer tool. White degrees, transparencies and milling degrees are measured by Satake milling meter.

Amylose content was analyzed by IRRI method (2002). The consistency of the gel was determined by the method of Cagampang et al. (1973) based on the gel length formed by 100 mg rice flour in 2 ml of 0.2 N KOH solution in a 13 x 100 mm test tube at room temperature. The gel length is classified into: hard (<40 mm), intermediate (40-60 mm) and soft (> 60 mm). The temperature of gelatinization of rice is assumed by determining the alkali value (Little et al. , 1958 in Graham, 2002). Six whole grains of rice were soaked in 10 ml of KOH solution of 1.7% for 24 hours at 30 ° C.

The water absorption ratio (WAR) and the volume expansion ratio (VER) are measured by cooking 8 g of rice in a measuring cup (the base has been replaced with wire netting). The measuring cup is inserted in a cup glass containing 160 ml of aquades and heated for 30 minutes. The measuring cup is lifted and left (5 minutes) to make the drain. Water Absorption Ratio is expressed as a comparison between the amount of water absorbed by the initial weight of the rice. While the VER is expressed as the ratio of rice volume to the initial rice volume (IRRI, 1974).

The cooking time is determined by boiling 5 g of rice head in a cup of 135 ml boiling water for 10 minutes. Each minute, 10 grains of rice were removed and placed between the two outer surfaces of the petridish and then pressed. The optimum cooking time is obtained when the whole grains of rice absorb water perfectly (no white dots are formed).

Data were analyzed using analysis of variance test followed by Duncan Multiple Range Test (DMRT) test when there was a difference. SPSS 14.0 software is used for the test. Data is presented in the form of average value.

RESULTS AND DISCUSSION

Paddy Quality

High quality grain will also produce high quality rice. Physical grain quality component that plays a role in determining the shelf life is moisture content. High moisture levels lead to grain damage due to chemical, biochemical and microbial processes. The grain moisture content of all samples used in this study varied between 10.6 and 12.6% and below 14%, in accordance with INS quality standard of paddy No. 0224-1987/SPI-TAN/01/01/1993 (BSN, 1993) (Table 1). Differences in conditions at harvest time and drying process are the factors causing differences in grain moisture content.

Table 1. Paddy Physical Quality

Variety	Moisture Content (%)	Density (g/l)	Weight of 1000 grain (g)	Empty + Dirty Grain (%)	Green + Chalky Grain (%)	Yellow + Damage Grain (%)
Ciherang	11.3 d	527 g	26.04 g	4.03 f	2.01 f	2.99 e
Black Rice	11.1 c	305 a	24.86 c	6.95 j	1.89 f	0.00 a
Inpari 1	11.4 de	550 ij	25.07 d	0.91 ab	0.33 b	0.41 b
Inpari 6	10.6 a	526 g	30.63 k	0.94 b	0.30 b	3.22 f
Inpara 3	12.3 g	520 e	25.56 f	2.92 d	0.59 c	8.25 k
Inpara 4	12.6 h	552 j	19.41 a	1.96 c	1.26 e	5.32 i
Rojolele	11.5 e	458 b	30.31 j	4.32 g	0.41 b	1.30 d
Mentikwangi	11.8 f	533 h	26.50 i	6.67 i	0.87 d	3.51 g
Pandanwangi	10.8 b	523 f	31.04 l	3.51 e	0.61 c	4.0 h
Hipa 8	10.7 ab	476 c	24.64 b	7.36 k	1.37 e	6.04 j
Situ Patenggang	10.6 a	549 i	26.18 h	0.88 a	0.06 a	1.32 d
Hipa 5 Ceva	11.0 c	499 d	25.18 e	6.41 h	2.34 g	1.12 c

The same letter in one column shows no significance difference (DMRT p> 0.05)

Other grain quality components are density values. Measurement of density (g/l) of grain is useful to know the yield of milled rice. Grain density is a measure that describes the weight of grain for units of volume expressed in units of grams per liter (g/l). The higher the grain density value means the weight of grain for each unit of the same volume is greater. This shows the level of filling of grain when in the optimal crop. Range of grain density of sample between 305-552 g/l and weight range 1000 grains 19.41-31.04 g. The results of statistical analysis show that the two parameters differed significantly for each variety (Table 1). The difference is probably due to differences in the conditions at the time of filling and the influence of varieties. The grain density of local varieties of Anak Daro and Inpari 10 was 570.5 g/l and 519.5 g/l respectively with the weight of 1000 grains of 17.29 g and 27.9 g (Indrasari *et al*., 2012 and Indrasari *et al*., 2015). Grain density and weight of 1000 grains have an effect on determining the yield of milled rice. The greater the density and weight of 1000 grains will result in a higher yield of milled rice. Rice density of rice varieties in Indonesia ranges from 454.4-577.0 g/l (Suismono *et al*., 2003). According Varnamkhasti et al. (2008), data on grain density is useful in designing silos and containers for grain storage. While the weight of 1000 grains is a characteristic or feature that can be derived (Mutters and Thompson, 2009).

Empty + dirty grain, green+ chalky grain and yellow+damaged grains are the prerequisites which is set forth in the INS grain quality standard no. 0224-1987 / SPI-TAN / 01/01/1993. In the standard it is determined that the maximum of grade III based on empty+dirty grain is 3%. Based on empty+dirty grain, only Inpari 1, Inpari 6, Inpara 3, Inpara 4. Rojolele, and Situ Patenggang who met these requirements. For green+chalky grains, all samples have met the class II quality standard (maximum 5%). For yellow + damaged grains all samples have met the class III grain quality standard (maximum 7%) except Inpara 3. The results of statistical analysis showed that the three parameters differed significantly on each variety (Table 1). The results of Indrasari et al. (2012 and 2015) shows

that the empty+ dirty grain of local varieties of Anak Daro and Inpari 10 are respectively at 1.90%. And 6.76% and green+chalky grains of local varieties Anak Daro and Inpari 10 were 0.50% and 0.3%, respectively. While the yellow+damaged grains of local varieties Anak Daro and Inpari 10 respectively amounted to 3.54% and 2.55%.

Physical Rice Quality

The milled rice moisture content of all samples below 14%, which means meets the quality standards of milled rice based on INS no. 01-6128-2008 (BSN. 2008). Another physical characteristic of milled rice that plays a role in determining the level of acceptance is the color of rice. Rice color criteria are measured relatively. Compared with the white crystal color BaSO4 which has a whiteness degree of 87%. In addition to black rice, the degree of white of other rice ranged from 41.0-56.4% (Table 2). The whiteness degree of rice in Indonesia ranges from 42-60%. The whiteness degree does not always affect the level of rice transparancy.

Table 2. Physical Quality of Milled Rice

Variety	Moisture Content (%)	Whiteness Degree (%)	Transparancy (%)	Milling Degree	Rice Shape		
					Length	Width	Ratio (L/W)
Ciherang	11.5 c	47.0 e	2.3 de	130 g	6.9 d	2.3 ab	3.0 d
Beras Hitam	11.3 bc	37.1 a	1.2 a	76.5 a	6.0 b	2.5 bc	2.2 a
Inpari 1	11.4 c	41.0 b	2.9 f	101 b	7.2 e	2.1 a	3.4 ef
Inpari 6	11.1 b	46.5 de	3.1 f	126.5 f	7.5 f	2.3 ab	3.2 de
Inpara 3	12.1 ef	45.0 c	2.3 de	114.5 c	7.4 ef	2.2 a	3.3 e
Inpara 4	12.3 ef	46.5 de	1.8 b	118.5 d	5.7 a	2.3 ab	2.5 c
Rojolele	11.8 d	52.2 g	3.0 f	152 i	6.9 d	2.7 cd	2.5 c
Mentikwangi	12.0 de	45.9 d	2.4 e	124.5 e	6.4 c	2.7 cd	2.4 bc
Pandanwangi	12.1 ef	55.7 h	3.0 f	168 k	6.3 c	2.9 d	2.1 a
Hipa 8	11.4 c	47.9 f	2.1 cd	126 f	7.6 f	2.1 a	3.6 f
Situ Patenggang	10.6 a	56.3 hi	2.1 cd	150 h	6.4 c	2.5 bc	2.5 c
Hipa 5 Ceva	12.2 ef	56.4 i	2.0 bc	164 j	7.4 ef	2.2 a	3.3 ef

The same letter in one column shows no significance difference (DMRT p> 0.05)

In addition to the color of rice, the physical characteristics of rice that directly affect the level of consumer preferences offer in milled rice is the transparency of rice grains. Consumers prefer white and transparant milled rice. The rice transparant is determined by the genetic traits and the milling method. The use of friction method is friction between rice grains will produce rice with a higher value of transparan than abrasive method that is friction with grinding stone. Inpari 6 is the transparance rice followed by Rojolele and Pandan Wangi. While Inpara 4 has the lowest transparance than black rice (Table 2).

The milling degree is a joint criterion between the whiteness degree and the transparancy of rice grain. Increased levels of rice husking produce in higher milled rice with higher degrees. Measurement of milling degree is carried out using Satake Milling Meter. As a comparison, white crystals of BaSO4 were used with a dosage value of 199. Except for black rice, the range of milling degrees of Inpari 1 (101) to Pandan wangi (168). Whiteness degree, transparancy, and milling degree significantly differed in each variety (Table 2). Whiteness degree, transparancy and milling degrees of local varieties of Anak Daro are 43.4%; 1.76 and 104 (Indrasari *et al*., 2012). While the whiteness degree, transparancy and the miliing degree of Inpari 10 are 45.6%; 1.91% and 115 (Indrasari *et al*., 2015).

The International Rice Research Institute (IRRI) (2009) classifies the length of rice as follows: very long (> 7.5 mm), length (6.61-7.5 mm), medium (5.51-6.60 mm), and short (<5.50 mm). Table 2

shows that Ciherang varieties, Inpari 1, Inpari 6, Inpara 3. Rojolele, Hipa 8 and Hipa 5 Ceva include long rice (6.61-7.5 mm) and the rest included medium rice (5.51-6.6 mm). There are length differences in rice between varieties.

Based on Table 2 it is known that the ratio of length and width of both samples analyzed ranged from 2.1 (Pandanwangi) to 3.6 (Hipa 8). The ratio of length and width of the rice determines the classification of the grain shape. The International Rice Research Institute (2009) classifies rice into 4 types: slender (> 3.0), medium (2.1-3.0), bold (1.1-2.0), and round (<= 1). Based on the classification, the shape Ciherang rice, Black Rice, Inpara 4, Rojolele, Mentikwangi, Pandanwangi and Situ Patenggang including medium shape and the rest Inpari 1, Inpari 6, Inpara 3, Hipa 8 and Hipa 5 Ceva including slender shaped. There is a difference in the form of rice between varieties. The rice shape of both Anak Daro and Inpari 10 varieties are slender (3.22 and 3.35) (Indrasari *et al*., 2012 and Indrasari *et al*., 2015). In general, consumers prefer rice with long grain and slender shape. Shape, size, weight and seed uniformity are important factors in the rice industry. The rice dimension determines in the international market because long rice has a high demand (Damardjati and Purwani 1991). In addition, information on the ratio of length and width is required in determining drying and processing equipment.

Milled Rice Quality

Head rice is a component of physical quality of rice that directly affects the level of acceptance by consumers. Consumers do not like milled rice with low head rice percentage. Standards of quality of milled rice based on INS No. 01-6128-1999 for the IV quality class requires a minimum of rice head of 73% with a moisture content of 14%. When compared with the requirements of the INS, the Ciherang rice, Situ Patenggang and Hipa 5 Ceva variety have not met the requirements set. Only Inpari 1 and Inpari 6 meet the quality class I (minimum 95%) based on the percentage of head rice (Table 3). The percentage of head rice of Anak Daro and Inpari 10 children was 93.21% and 77.21% respectively (Indrasari *et al*. 2012 and Indrasari *et al*. 2015).

Conversely with head rice, high percentage of broken rice cause declining of consumer acceptance. For domestic food procurement, according to quality standards of milled rice (class IV), the maximum of the percentage of broken rice is 25%. Thus Ciherang, Situ Patenggang, and Hipa5 Ceva rice has not met the established requirements (Table 4). The percentage of brown rice of Anak Daro and Inpari 10 varieties were 5.88% and 22.04% (Indrasari *et al*., 2012 and Indrasari *et al.,* 2015). Parameters of head rice and broken rice differed significantly on each variety (Table 3). One of the factors that determine the high broken rice in milled rice is moisture content. When grain was milling with low moisture content will cause high broken grain. Conversely, if too wet will produce a high grain groats.

For domestic food procurement, Bulog refers to the standard quality of rice class IV that is INS No. 01-6128-1999. At that standard groat grains in milled rice maximum 2%. The data in Table 4 indicates that the percentage of groat grains used in the sample sample is less than 2%. The groat grains differed significantly in each variety except in Ciherang, Black Rice and Rojolele (Table 4). The percentage groats of Anak Daro and Inpari 10 varieties by 0.91% and 0.85% (Indrasari *et al*., 2012 and Indrasari *et al*., 2015).

Immature+chalky grains and yellow+damaged grains are the components consumers consider in choosing the rice they buy. In general, consumers do not like milled rice with Immature+chalky grain content and high yellow+damaged grains. In relation to this, Bulog requires immature+chalky grain content and yellow+damaged grains of maximum of 3% each. Compared with these requirements, all samples of rice used have met the established requirements (Table 4). The immature+chalky grains and yellow+damaged grains of Anak Daro varieties by 0.28% and 1.90% respectively and Inpari 10 0.56% and 1.27% respectively(Indrasari *et al*., 2012 and Indrasari *et al*., 2015).

Table 3. Milled Rice Quality

Variety	Head Rice (%)	Broken Rice (%)	Groats (%)	Immature+ Chalky Grain (%)	Yellow + Damage Grain (%)	Yield (%)	
						Brown Rice	Milled Rice
Ciherang	61.3 a	38.4 j	0.3 ab	2.1 g	0.4 bc	79.8 f	70.5 h
Black Rice	91.9 i	7.8 c	0.2 ab	3.0 h	0.4 bc	77.2 c	65.1 b
Inpari 1	97.6 k	2.6 a	0.1 a	0.2 ab	1.6 ef	79.7 f	72.0 j
Inpari 6	97.1 j	2.7 a	0.1 a	0.1 ab	0.1 a	79.4 e	71.6 i
Inpara 3	76.9 f	22.5 f	0.7 c	0.7 d	0.3 ab	75.7 a	66.7 d
Inpara 4	84.1 g	13.0 e	0.9 c	1.1 e	1.3 d	76.4 b	64.7 a
Rojolele	72.2 d	2.6 a	0.3 ab	0.3 bc	0.5 ab	79.8 f	70.3 h
Mentikwangi	92.6 i	7.4 b	0.1 a	0.3 bc	1.5 de	77.3 c	69.4 f
Pandanwangi	87.9 h	11.9 d	0.1 a	0.5 cd	0.3 ab	80.4 g	70.3 h
Hipa 8	74.3 e	24.9 g	0.9 c	1.5 f	1.8 f	78.2 d	68.0 e
Situ Patenggang	62.5 b	37.1 i	0.4 b	0.0 a	0.3 ab	78.4 d	69.8 g
Hipa 5 Ceva	64.5 c	34.2 h	1.2 d	2.9 h	0.6 c	78.3 d	66.2 i

The same letter in one column shows no significance difference (DMRT p> 0.05)

Based on the rice yield, the yield of brown rice ranged from 75.7% (Inpara 3) to 80.4% (Pandanwangi). While the yield of milled rice ranged from 65.1% (Black Rice) to 72% (Inpari 1). The yield of brown rice and milled rice differed significantly in some varieties (Table 3). The yield of brown rice and milled rice of Anak Daro local rice varieties amounted to 77.77% and 70.02%. While the yield of brown rice and milled rice of Inpari 10 varieties amounted to 78.28 and 71.75% (Indrasari *et al*., 2012 and Indrasari et al., 2015). The yield of milled rice is affected by grain density and weight of 1000 grains. The greater the density and weight of 1000 grains will result in a higher yield of milled rice. In Table 2, Inpari1 rice has a density (550 g/l) and high weight of 1000 grains (25.07 g).

Physicochemical Properties of Rice

Amylose content, gelatinization temperature and the consistency gel of rice are shown in Table 4. The texture of the rice is closely related to the amylose content of the rice. Juliano (1993) divides amylose into 4 groups: very low amylose (<10%) yields sticky rice, low amylose (10-20%) produces very soft cooked rice, intermediate amylose (20-25%) produces soft cooked rice and high amylose (> 25%) yields hard cooked rice. The gel consistency measures the tendency of the cooked rice to harden on cooling. The gel consistency is determined by heating a small quantity of rice in a dilute alkali. This test differentiate the consistency of cold 5.0% milled rice paste. Within the same amylose group, varieties with a softer gel consistensy are preferred, and the cooked rice a higher degree of tenderness. Harder gel consistency is associated with harder cooked rice and this feature is particularly evident in high-amylose. Rice is grouped into 3 groups based on the gel consistency, namely rice with a hard gel consistency (very flaky rices) with gel length ≤ 40 mm, rice with intermediate gel consistency (flaky rices) with gel length 41-60 mm, and rice with low gel consistency (soft rices) with gel length ≥ 61 mm (Cruz and Khush, 2000).

The temperature of gelatinization is the temperature when 90% of starch granules are swelled (irreversible), lost its crystal form, as well as loss of birefringence character. The gelatinization temperature will be achieved if the starch is heated by addition of water. The timing of gelatinization temperature is usually used to determine the length of cooking time. The temperature of starch gelatinization ranges from 55-79^{o}C. Depending on the type of plant and its varieties (Cruz and Khush 2000). Rice with high gelatinization temperatures is less fluid when cooked than rice with medium and low gelatinization temperatures (Suismono, 2003). The environmental conditions of rice crops can affect the temperature of gelatinization. One of the influencing environmental factors is temperature. The process of ripening of paddy grains occurring at high temperatures will produce rice with higher gelatinization temperatures (Cruz and Khush 2000). The determination of starch gelatinization

temperature in this study using alkali test method. Rice is classified into 3 groups based on its gelatinization temperature, namely low gelatinized rice (<70°C), intermediate gelatinized rice (70-74°C), and high gelatinized rice (> 74°C).

Table 4. Physicochemical Properties of Rice

Variety	Amylose (%)	Gelatinization Temperature		Gel Consistency	
		Score	Temperature (°C)	(mm)	Explanation
Ciherang	22.65	1	>74	64	Soft
Beras Hitam	21.39	5	70–74	63	Soft
Inpari 1	22.65	1	>74	61	Soft
Inpari 6	17.26	6	55–69	86	Soft
Inpara 3	26.23	7	55–69	65	Soft
Inpara 4	25.73	1	>74	56	Intermediate
Rojolele	22.47	4	70–74	67	Soft
Mentikwangi	19.32	5	70–74	88	Soft
Pandanwangi	24.21	5	70–74	68	Soft
Hipa 8	19.36	5	70–74	81	Soft
Situ Patenggang	20.63	7	>74	63	Soft
Hipa 5 Ceva	22.87	1	>74	65	Soft

Ciherang rice (22.65%), Inpari 1 (22.65%), Situ Patenggang (20.63%), and Hipa 5 Ceva (22.87%) was included in the intermediate amylose group, high gelatinization temperature and soft gel consistency. Black rice from Cibeusi Subang, Rojolele, Mentikwangi, Pandanwangi, and Hipa 8 belongs to the intermediate amylose group, medium gelatinization temperature and soft gel consistency. Inpari 6 is a intermediate amylose group, low gelatinization temperature and soft gel consistency. Inpara 3 includes in high amylose groups, low gelatinization temperature and soft gel consistency. While Inpara 4 includes in high amylose group, high gelatinization temperature and intermediate gel consistency. The local rice of Anak Daro is included in intermediate amylose, gelatinization temperature> 74°C high, and hard gel consistency. While Inpari 10 rice is included in intermediate amylose, intermediate gelatinization temperature and intermediate consistency gels (Indrasari *et al*. 2012 and Indrasari *et al.,* 2015).

Water requirements for cooking rice for each variety are different. This is because each variety has different water absorption rate. The amount of water absorption is due to differences in amylose levels, which causes the difference in the number of active groups. The average water absorption from Indonesian rice is 2.5 times. The greater the level of water absorption the more water required to cook the rice. While the level of rice volume development in Indonesia is on average 3.5 times compared to the volume of rice (Suismono *et al.* 2003). The water absorption ratio (WAR) is expressed as the ratio of the amount of water absorbed to the initial weight of the rice. While the volume expansion ratio (VER) is expressed as the ratio between the volume of rice and the initial rice volume. The WAR range of rice samples used between 3.05-3.60 times. While the VER ranges from 2.54 - 3.13. time. There is a difference between WAR and VER between varieties. The cooking time rice ranges from 17 to 19 minutes but there is no difference between varieties (Table 5). The local rice Anak Daro has WAR and VER of 4.3 and 3.4 (Indrasari *et al.,* 2012). The VER of five rice varieties produced in Ohaukwu Local Government Area in Nigeria ranges from 1.67-3.67 with Caprice and IRR8 varieties having the highest and the least values respectively. While the cooking time of rice samples from Nigeria ranged between 17 to 23 minutes with Faro 15 having the highest value and Caprice having the lowest value (Chukwuemeka *et al.,* 2015).

Table 5. Cooking Time Quality

Variety	Ratio		Cooking time (minute)
	Water Absorption Ratio (WAR)	Volume Expansion Ratio (VER)	
Ciherang	3.44 ef	2.88 de	19 a
Beras Hitam	3.42 e	2.75 bc	17 a
Inpari 1	3.51 fg	2.75 bc	18 a
Inpari 6	3.28 cd	2.54 a	18 a
Inpara 3	3.31 d	2.83 cd	18 a
Inpara 4	3.22 bc	3.00 ef	19 a
Rojolele	3.48 efg	2.81 bcd	18 a
Mentikwangi	3.16 b	2.90 de	18 a
Pandanwangi	3.05 a	2.69 b	19 a
Hipa 8	3.60 gh	3.09 fg	18 a
Situ Patenggang	3.54 g	3.13 g	18 a
Hipa 5 Ceva	3.48 efg	2.81 bcd	19 a

The same letter in one column shows no significance difference (DMRT p> 0.05)

CONCLUSION

Out of 12 varieties, Local Black Rice, Mentikwangi, Inpari 1, and Inpari 6 had the best quality based on head rice percentage and milled rice yield. The head rice percentage for Local Black Rice and Mentikwangi had fulfilled for class II, while Inpari 1 and Inpari 6 had fulfilled for class I INS No. 6128:2008. Local Black Rice and Mentikwangi were grouped to varieties that had intermediate amylose, intermediate gelatinization temperature, and soft gel consistency. Inpari 1 was classified to varieties that had intermediate amylose, high gelatinization temperature, and soft gel consistency. Inpari 6 was included to varieties that had intermediate amylose, low gelatinization temperature, and soft gel consistency.

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SURIMI BASED EDIBLE COATING FROM RED SNAPPER FILLET WASTE WITH SECANG EXTRACT (*Caesalpinia sappan* L) ADDITION AS COOKED SHRIMP COATING

[1*)] Iis Rostini, [2)] Bustami Ibrahim, [2)] Wini Trilaksani

[1)] Department of Fisheries Product Processing, Padjadjaran University, Indonesia
[2)] Department of Aquatic Processing Technology, Bogor Agricultural University, Indonesia

[*)] Correspondence e-mail: iis.rostini@unpad.ac.id

Abstract

Surimi based edible coating from Red Snapper fillet waste combined with natural colorant from secang extract (*Caesalpinia sappan* L) to defend cooked shrimp color. The purpose of this study was to determine physical characteristics of edible coating made from meat of red snapper fillet waste and examine the application of surimi edible coating that combined with secang extract to cooked shrimp. The study was comprised to some stages, they were making of surimi from meat of red snapper fillet waste (*Lutjanus* sp.), secang extraction, making of edible coating, and edible coating application to cooked shrimp. Surimi concentration that used as edible coating were 2, 6, 10, and 14% (w/v), each edible coating treated with two treatments, which were without and added by secang extract. Analysis in this study including total volatile base (TVB), pH, viscosity, organoleptic, and color test. The study resulted that the improvement of surimi concentration caused edible coating viscosity to be increased. Surimi edible coating application to cooked shrimp, based on hedonic and color test giving the result were edible coating with 14% surimi concentration was the most acceptable by panelist and giving the highest of shrimp color.

Keywords : cooked shrimp, edible coating, fillet waste, secang extract, surimi

INTRODUCTION

Fish meat remaining in bone from fillet waste has been underutilized, usually collected and sold in traditional markets for consumption or milling into fish meal. Increase of value added can be done to the meat of the remaining fish fillet that was as raw material in making surimi. Surimi in the food industry can be used as an ingredient to make protein-based edible coatings (Shiku et al., 2004). Edible coatings are potential to be used as packaging materials as they may affect the quality, food safety, and shelf life of the product. Besides acting as an inhibitor of mass diffusion (moisture, gas, volatile), edible coating also acts as a food and additive carrier including flavors, antioxidants, vitamins and dyes (Cagri et al., 2004), as well as to improve the handling food (Krochta and Johnston, 1997).

The color of cooked shrimp is one of the attributes that affect the quality and acceptance of the product. The ability of edible coating in maintaining the color of cooked shrimp can be applied with natural dye secang (*Caesalpinia sappan* L) which were antioxidant and antimicrobial, so they can produce better products. Edible coatings and antimicrobial agents can be incorporated during the film-making process to improve the safety and lifetime of ready-to-eat food (Cagri et al., 2004). Edible coating can be used to extend the shelf life and maintain the product quality (Kilincceker et al., 2009). Antioxidants are also important in cooked shrimp to prevent the occurrence of oxidation so as to maintain the color. Secang can be utilized as a source of natural color because they contain substances of pigment red brazilin and is soluble in hot water (Sanusi, 1993). Secang also has antioxidant activity, according to Yingming et al. (2004), beverage-based secang (*Caesalpinia sappan* L.) containing brazillin has high antioxidant activity. According to Weningtyas (2009), the highest antioxidant activity in extracts of *Caesalpinia sappan* L at the concentration of 2.5 mg/ml.

The effort to produce good quality surimi has been conducted through various research, but research on the edible coating made from surimi recently little was done, including edible coating from Alaska Pollack surimi (Shiku et al., 2004) and edible film surimi based from tuna fish (Chinabhark et al., 2007). Development of edible coatings made from surimi and its application in the field of the fishing industry needs to be known. Based on the study of the method of making edible coating of surimi and application to protect cooked shrimp became more important to do. The purpose of this study was to determine physical characteristics of edible coating made from meat of red snapper fillet waste and examine the application of surimi edible coating that combined with secang extract to cooked shrimp.

RESEARCH METHOD

Materials

The material used in this research were meat of red snapper fillet waste, Vanname shrimp (*Litopenaeus vannamei*) in the form of PUD (peeled undevine) with size 60-70 (in 1 kg there are 60-70 PUD shrimp), secang (*Caesalpinia sappan* L), aquadest, NaOH, and sorbitol.

Methods

The study was comprised to some stages, they were preparation of surimi from meat of red snapper fillet waste (*Lutjanus* sp.), secang extraction, preparation of edible coating, and edible coating application to cooked shrimp. Surimi concentration that used as edible coating were 2, 6, 10, and 14% (w/v), each edible coating treated with two treatments, which were without and added by secang extract. Analysis in this study including total volatile base (TVB) and pH to red snapper meat, edible coating viscosity, organoleptic and color test to cooked shrimp with edible coating.

Preparation of Surimi from Red Snapper Fillet Waste Meat

The method of surimi preparation was a modification of Suzuki (1981). The fish meat was ground with a grinder and then washed and soaked twice with cold water (15 ± 1) ^{o}C and 0.3% (w/v) salt solution. Soaking by using cold water (water ratio: meat was 3: 1) for 10 minutes. Once soaked, the meat is squeezed using a calico cloth to remove water. Furthermore, sorbitol added 2% (w / w) and mixed using food processor until homogeneous, then put into polyethylene plastic and stored in freezer at -15^{o}C.

Secang (Caesalpinia sappan L*.) Extraction*

Dried secang wood milled to reduce the size by using Hammer Mill filtered with 40 mesh sieve. Wood shavings secang used for the next stage of the extraction stage. The extraction of wood pigment secang was done using Ye Min et al. (2006) with water solvent. The material (100 g) was extracted with 1 liter of water and was repeated 3 times for 30 minutes at 80 ° C. After that it was filtered with a vacuum filter using the paper Whatman No.1 and pH filtrate was measured. The extract was concentrated with a vacuum evaporator at a temperature of 40 °C to remove the remaining solvent to obtain an extract of dried powder. Powder extract secang then mixed into edible coating as a natural dye for cooking shrimp as much as 2.5 mg / ml. The secang extract at this concentration has the highest antioxidant activity (Weningtyas, 2009), so it is expected to maintain the color of boiled shrimp during storage.

Preparation of The Surimi Edible Coating

Preparation of edible coating based on method Shiku et al. (2004). The concentration of surimi used as edible coating solution are 2, 6, 10, and 14% (b/v). Surimi was stirred and heated (30 min, 55 ^{o}C) with the addition of distilled water up to 150 ml and 1 M NaOH to pH 11. Surimi filtered solution (150 nylon mesh), and thus obtained the filtrate as edible coating surimi. Each edible coating consists of two treatments, which were without extracts and addition by the extract of secang. Then analyzed the viscosity of surimi edible coating.

Edible Coating Application on Cooked Shrimp

Shrimp boiled for 5 minutes, drained, and dipped into a solution of edible coating for 10 minutes. The next is analysis of cooked shrimp colour (Chromometer CR200 with Hunter notation system (L*a*b*)) and do testing organoleptic with hedonic test.

Statistical Analysis

Statistics, on a factorial completely randomized design, Multiple Comparison Tukey-HSD test ($p \leq 0.05$) was used to determine significance of differences between means (Steel and Torrie, 1993). Organoleptic results analyzed with statistical tests by Kruskal Wallis.

RESULTS AND DISCUSSION

Edible Coating Material

Analysis of raw material including Total Volatile Base (TVB) obtained result of 8,58 ± 0,01 mg N/ 100g and pH value 6,8 ± 0,05. TVB and pH values indicate that red snapper meat filet meat has been taken down, but even at an early point. A TVB value less than 10 mg / 100g indicates the fish is even really fresh (Farber, 1965). The pH value can affect gel strength. The gel strength will be higher if the pH of the meat ranges from 6.0 to 7.0, this is due to missing easily soluble in the pH range (Shimizu, 1992). The fish fillet waste meat used in the study shows very fresh meat, so that when used as a raw material in the preparation of surimi can produce high gel strength.

Natural Dyes from *Caesalpinia sappan L*

Based on the results of the extraction using a solvent to water, obtained yield sufficiently high, namely 5.7% (± 0.03). The solvent water yield most to extract ethanol solvent compared to secang (Weningtyas, 2009). pH value of secang solution before powder form is 6.4 ± 0.05 in red. The acidity or pH conditions greatly affect the stability of the pigment color to brazilein. At pH 6-7 secang color is red (Adawiyah and Indriati, 2003). *Caesalpinia sappan* wood extracts produced after evaporation is reddish colored floured.

Surimi Edible Coating

Edible coating made from surimi with various concentration 2%, 6%, 10%, and 14%. Edible coating formed clear-colored and the higher the concentration the appearance become increasingly murky. Addition secang extract of 2.5 mg/ml into edible coating produces a deep red color, the color is produced because the coating has a pH alkaline approach 7.8 ± 0.04. Edible coating of surimi waste fillets Red Snapper at different concentrations are presented in Figure 1 and for edible coating with the addition secang extract is presented in Figure 2.

Figure 1: Surimi edible coating in various surimi concentration

Figure 2: Surimi edible coating in various surimi concentration with addition of 2,5 mg/ml *Caesalpinia sappan* L. extract.

Edible coating mixed with secang extract has lower viscosity grades when compared with edible coating which is not given the secang extract. The value of edible coating viscosity surimi waste red snapper filet is presented in Figure 3. Granting of extracts of Caesalpinia sappan after edible coating formed.

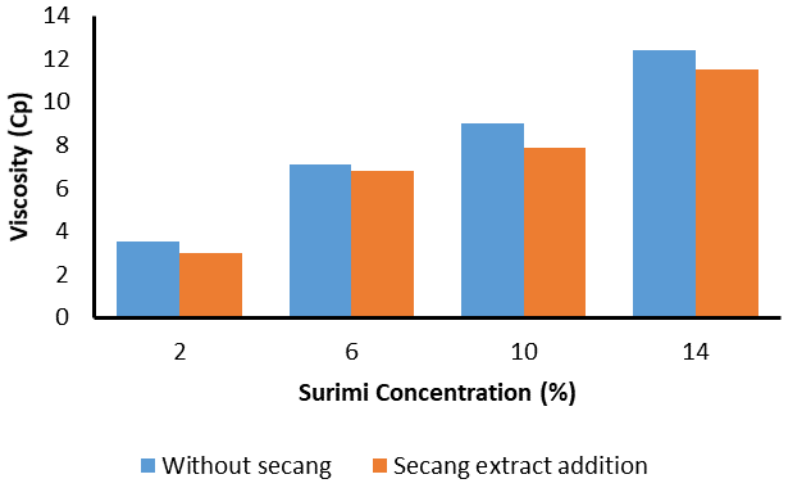

Figure 3: The value of edible coating viscosity from surimi Red Snapper fillet waste.

The analysis of variance showed that the treatment of secang, surimi concentration and interaction both gave a significant influence ($P < 0.05$) on the value of edible coating viscosity. Overall the greater concentration of surimi is added, then the value of edible coating viscosity be increased. This is due to the amount of protein added to the surimi in solution undergo denaturation by bases added in the process of making edible coating. The bonds of molecules are damaged, then the molecule will be expanding and developing this molecule resulting in increased viscosity (Winarno, 2008). Increasing number of dissolved substances as surimi is added it will also increase the amount of dissolved solids in edible coating. The viscosity is influenced by the substance that dissolved in a solution, if the amount of dissolve more increase and the solution more viscous then the resulting viscosity value will be higher. Colloidal suspension in aqueous solution can be increased by means of

the liquid thicken. Development of molecule dissolved substances resulting in increased viscosity (Winarno, 2008).

Edible coating with the addition of secang extract there is little lumps at the base of the container edible coating. This occurs because the extract of secang contain tannin. Tannins contained in secang join extracted during the extraction process, because the tannin is polar compound that is soluble in water and ethanol. Tannin content in the secang extract obtained with water was 0.137% (Winarti and Sembiring, 1998). Tannin in extracts of secang reacts with surimi contained in edible coating, this is due to the surimi is a protein has a positive charge and the negatively charged tannin so that occur the binding mechanism of tannin by protein through an electric charge. According to Siebert (1996), the protein will settle along the tannins to form insoluble complexes. The interaction of tannins with proteins to form hydrogen bonds, which resulted in a second weight molecules that bind is increased so that the deposition took place. Based on such things as well, most surimi contained in edible coating will bind with tannin contained in extracts of secang. The addition of secang extract containing negatively charged tannin caused a number of negative ions in solution so excess salting out effect. Salting out can be described as a phenomenon where water cannot dissolve due to the ions dissolved in the saturated conditions (Hasseine et al., 2008). This led to a number of substances dissolved in edible coating be reduced, thus viscosity becomes lower compared with edible coating which is not given the extract of secang.

Organoleptic Assessment

Organoleptic test is performed with the hedonic. Hedonic test is carried out on this research aims to know the level of consumer acceptance against a cooked shrimp coated in edible coating. Edible coatings consist of two types, which are without and addition with secang extract as much as 2.5 mg/ml. Characteristics of the tested include appearance, color, aroma and taste. The hedonic test results of cooked shrimp are coated in edible coating surimi is presented in Figure 4 and cooked shrimp are coated in edible coating surimi with the addition of secang extract is presented in Figure 5.

Application of edible coating on cooked shrimp based on the hedonic test showed that the most preference by panelists is 14% on either the cooked shrimp coated by surimi edible coating without and addition of secang extract. This occurs because the concentration of surimi 14% can form an edible coating well. At the time it was applied on the cooked shrimp, the edible coating can cover the surface of the cooked shrimp perfectly, so being able to make the surface of the cooked shrimp looks crystal clear, transparent, shiny and bright. According to Krochta (1992), the use of edible coatings can reduce the rate of damage during the process, improve the texture and appearance of the product.

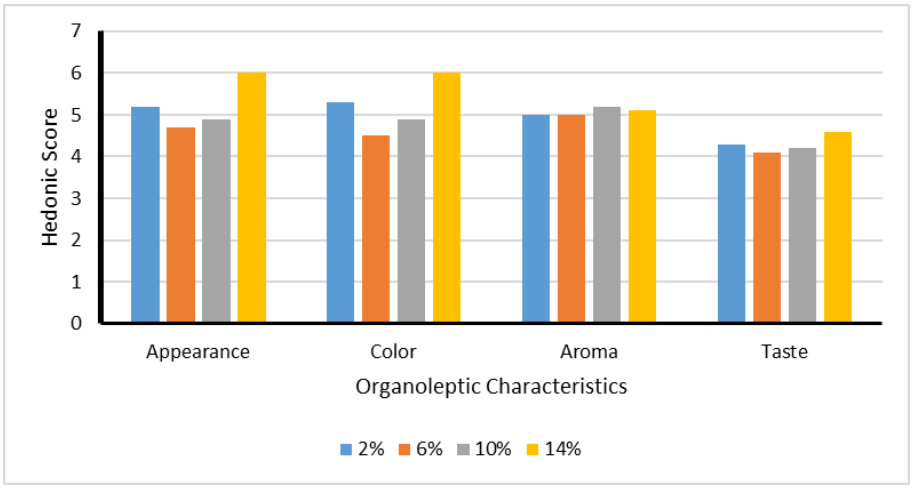

Figure 4: Hedonic test on cooked shrimp coated by surimi edible coating.

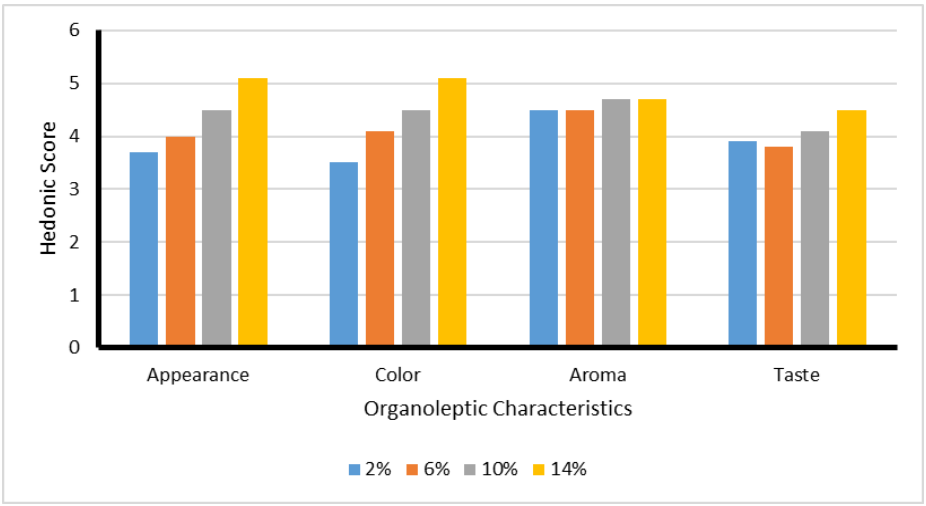

Figure 5: Hedonic test on cooked shrimp coated by surimi edible coating with addition by secang extract of 2.5 mg/ml.

The color attribute is very important and should always be considered, because of the influence directly to the quality of a product (Niamnuy, 2008). Surimi edible coating also is able to fix the color of the cooked shrimp so much liked by the panelists. The value of cooked shrimp color is coated in edible coating surimi and cooked shrimp are coated in edible coating with the addition secang extract has highest value on surimi 14% concentration. Surimi concentrations 14% against edible coating which applicate on boiled shrimp are able to fix the color of cooked shrimp, cooked shrimp has more colors bright and shiny so much liked by the panelists. Edible coatings are effective in reducing the loss of quality products include color, odor, and firmness (Mastromatteo, 2010). Based on the results of the analysis using the Kruskal-Wallis test results obtained that the concentration of surimi in edible coating surimi and surimi edible coating by addition secang extract gave the significant influence on the color of cooked shrimp.

Based on the results of hedonic test, edible coating applications on cooked shrimp showed that concentrations of surimi in edible coating which applicate on cooked shrimp, which is most preference by panelists is 14%. The most preferred concentration well in edible coating without and in edible coating that addition with secang extract.

Colour test of shrimp at various surimi concentrations in the edible coating

Color of food is a sensory attribute affecting the quality and acceptance of food products. Color test results on coated cooked shrimp from surimi red snapper fillet waste, presented in Figure 6, 7, and 8.

Based on Figure 6, the average value of L* cooked shrimp coated with surimi edible coating ranged from 72.25 to 78.07 the highest value at a concentration of 14% surimi and the lowest at 2% concentration of surimi. The average value of L* cooked shrimp coated with surimi edible coating added by secang extract ranged from 69.76 to 77.53, the highest value at 14% concentration of surimi and surimi lowest at 6% concentration.

Based on Figure 6, the value of L* cooked shrimp tends to increase with the increasing concentration of surimi were added to the edible coating. L* value of the cooked shrimp with edible coating concentration of 14% surimi highest compared to others. The results are shown both on the treatment given or not given secang extract. This is due to the concentration of 14% edible coating that forms a stable gel properties, when applied to the edible coating of cooked shrimp perfectly capable of covering the surface, so the cooked shrimp become shiny and bright.

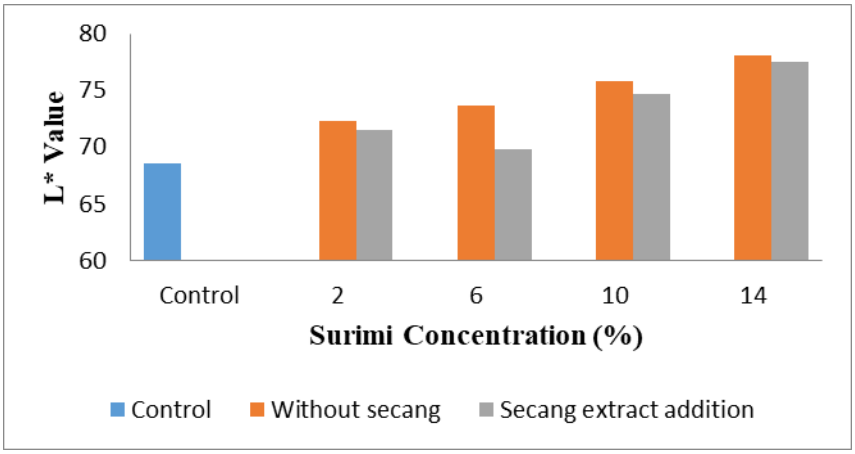

Figure 6: L* value of cooked shrimp coated by surimi edible coating

Analysis of variance showed that the concentration of surimi, secang treatment and their interaction gives significant effect ($p < 0.05$) to the L* value of cooked shrimp. Further Tukey test showed significant effect of interaction between secang treatment at surimi concentration of 2%, 6%, 10% and 14%.

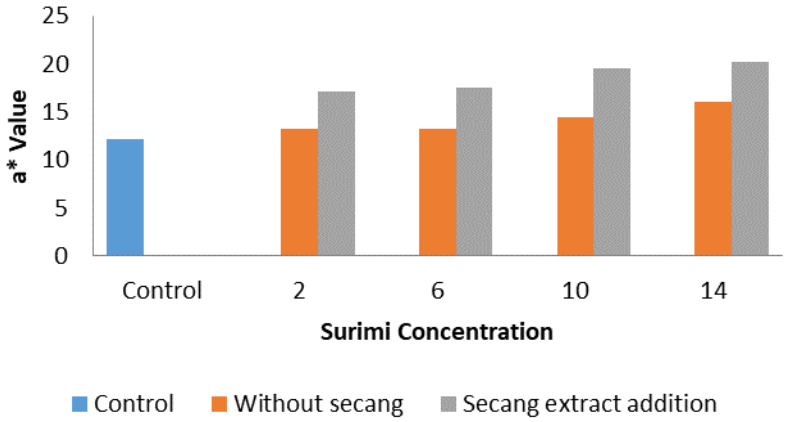

Figure 7: a* value cooked shrimp are coated by surimi edible coating

Based on Figure 7. shows the average value of a* cooked shrimp are coated surimi edible coating ranged from 13.21 to 16.06, the highest value at 14% concentration of surimi and surimi lowest at 2% concentration. The average value of a * cooked shrimp coated with surimi edible coating added by secang extract ranged from 17.09 to 20.22 the highest value at a concentration of 14% surimi and surimi lowest at 2% concentration.

Based on data from a* values in Figure 7 shows that the cooked shrimp are coated surimi edible coating without secang with a concentration of 2% has the smallest value of the chromatic red but it is positive. This indicates that chromatic colors are still contained within the range of the color red. Red chromatic highest value shown in cooked shrimp coated with edible coating concentration of 14% surimi were given secang extracts. Edible coatings are given secang extracts chromatic yield a higher value compared to extract edible coating without secang. This suggests that edible coating

combined with natural dyes secang can provide a sharper red color on cooked shrimp, cooked shrimp so that the color becomes more attractive consumers.

Analysis of variance showed that the concentration of surimi, secang treatment, and their interaction gave significant effect ($p < 0.05$) to the value of a* cooked shrimp. Further Tukey test showed significant effect of interaction between secang treatment at surimi concentration of 2%, 6%, 10% and 14%.

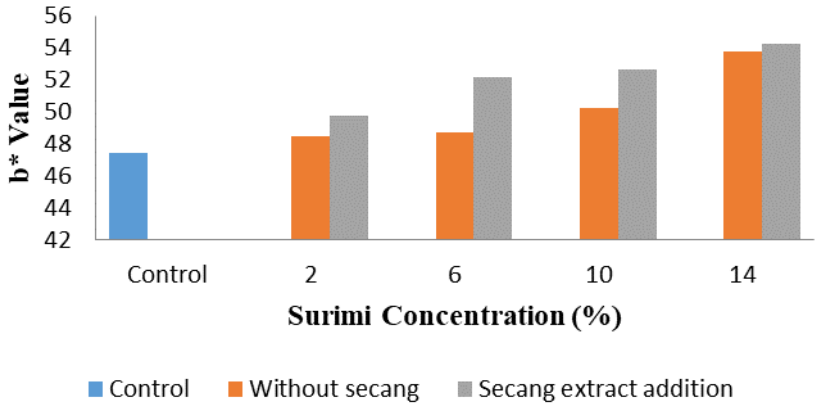

Figure 8: b* value of cooked shrimp coated by surimi edible coating

The average value of b* cooked shrimp is coated surimi edible coating ranged from 48.46 to 53.74. Highest value at 14% concentration of surimi and surimi lowest at 2% concentration. The average value of b * cooked shrimp coated with surimi edible coating added by secang extract ranged from 49.73 to 54.28, the highest value at 14% concentration of surimi and surimi lowest at 2% concentration.

Based on Figure 8, the value of b* tends to increase with the increasing concentration of surimi were added to the edible coating. b* values on cooked shrimp with edible coating concentration of 14% surimi highest compared to others. The results are shown both on the treatment given secang extract or not given. Yellow chromatic highest value shown in cooked shrimp coated with edible coating concentration of 14% surimi were given secang extracts. Edible coatings are given secang extracts chromatic yield a higher value compared to extract edible coating without secang. This suggests that edible coating combined with natural dyes can give yellow cup on cooked shrimp, so it can improve the color of cooked shrimp.

Analysis of variance showed that the concentration of surimi, secang treatment, and their interaction gave significant effect ($p < 0.05$) b* values of the cooked shrimp. Further Tukey test showed significant effect of between interaction secang treatment at surimi concentration of 2%, 6%, 10% and 14%.

CONCLUSION

Edible coating can form of surimi made from red snapper fillet waste. Edible coating formed can dissolve the secang extract which served as natural coloring on the stage of the application on the cooked shrimp. The higher of surimi concentration, then the higher the viscosity, brightness values as well as the color of cooked shrimp are getting better. Based on the hedonic and color test, obtained the results that the concentration of surimi in edible coating most preference by panelists and generate the level of brightness and color of the highest is amounted to 14%.

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AMINO ACID PROFILE AND VOLATILE COMPONENTS OF FRESH AND STEAMED VANAME SHRIMP (*Litopenaeus vannamei*)

[1*)] Rusky Intan Pratama, [1)] Iis Rostini, [1)] Emma Rochima

[1)] Fisheries and Marine Science Faculty, Padjadjaran University, Indonesia

[*)] Correspondence e-mail: rusky@unpad.ac.id

Abstract

Processing method such as steaming could affect volatile flavor composition and amino acids profile of fisheries commodity. The objectives of this research were to identify volatile components and amino acids profile of fresh and steamed Vaname shrimp (*Litopenaeus vannamei*). The method used in this study were to detect volatile compounds using Gas Chromatography/Mass Spectrometry on fresh and steamed samples (100^{o}C, 30 minutes) with Solid Phase Micro Extraction as initial samples extraction method using two different temperatures (35^{o}C for fresh samples and 70^{o}C for steamed samples), and also amino acids profile was analyzed using High Performance Liquid Chromatography. The volatile components analysis successfully detects 19 volatiles compounds in fresh Vaname shrimp while 58 compounds were detected in steamed samples. Most of the detected components came from hydrocarbons, aldehydes, alcohols and ketones groups. The amino acids profile identification results showed that glutamic acid had the highest content (3.08% and 4.70% were found in fresh and steamed Vaname shrimp consecutively) compared to other amino acids standards.

Keywords : Vaname, shrimp, flavor, volatiles, amino acids

INTRODUCTION

Shrimp have become an economically important species in Indonesia. Many of north and south region of West Java cultured Vaname shrimp (*Litopenaeus vannamei*) in ponds. Indramayu district is a main producer of Vaname shrimp in West Java province with 18,386.06 tons or 72.81% of total production. Vaname production value in Indonesia has reach as much as Rp 676,266,090,000 (KKP Statistical Data and Information Centre, 2013).

Traditional processing would affect flavor characteristics of a product or commodity. Thermal process such as steaming is a method that generally used in traditional processing in West Java for making food product named ”pepes” or local steamed fish with various spices. Steaming or vapor application as its heat source has an advantage which is it has smaller risk on the loss of heat sensitive vitamin and other food compounds (Fellow, 2000). The basic properties of fish meat or other parts of fish which are used as main ingredients would be changed and affected by ongoing steaming process. Most of the changes that happened were caused by flavor and textural changes when ingredients are undergoing processing steps. Various fishery commodities would have differences on their flavor composition whether they are still in the fresh form or after the commodities have been processed.

Shrimps are usually processed by heating prior to consumption. During processing shrimp meat develop a desirable roasted, sweet and fishy aroma (Mall & Schieberle, 2016). Generally each commodity is known to have different flavor compounds composition. Many of the research on flavor composition in Indonesia have been done on agricultural commodities as its object but on the contrary for fishery commodities in Indonesia, the similar research on flavor compounds were not easily available. Flavor itself is one of the most important factors in fresh and processed food in general, especially fisheries based products, mainly due to it could affected preferences, acceptance and consumption level. In general, flavor compounds that derived from fishery commodities could be divided in two categories, one is volatile flavor and the other is non-volatile flavor compounds. Volatile

flavor compounds would contributed to aroma of a product or commodity. The fishy characteristic and roasty aroma of processed crustacean meat is highly appreciated by consumers all around the world. Although several odorants may be generated due to enzymatic reactions, the thermal formation of aroma compounds from odorless precursors which were located in flesh and shell part, plays an important role in the overall aroma of processed prawn meat (Mall & Schieberle, 2016).

Most of the volatiles the compounds groups detected in fresh fisheries samples were came from various hydrocarbons, aldehyde, ketones, alcohols, various sulphur, nitrogen, heterocyclic compounds, esters and their derivatives (Tanchotikul & Hsieh, 1989; Liu et al., 2009; Pratama et al., 2013), while a wide varieties of volatile compounds have been detected and identified in processed samples one and their types and composition would depend on the samples type (Pratama 2011; Pratama et al., 2013). Nonvolatile flavor compounds are usually derived from free amino acids, various peptides, nucleotides such as IMP (*disodium* 5'-*inosine monophosphate*), GMP (*disodium* 5'-*guanosine monophosphate*), AMP (*disodium* 5'-*adenosine monophosphate*) (Chen & Zhang, 2006; Liu et al., 2009).

Shrimp is an excellent source of protein. Amino acids profile could provide is with general information regarding essential and non-essential amino acids composition and to point out which one of the overall amino acids that could affect taste characteristics of the samples. These become important because amino acids composition could affect products protein quality. Heating causes chemical changes in the amino acids residues, which could modify the structural, digestible and functional properties of proteins depending on the applied thermal treatment and processing conditions. Amino acids and peptides contributes directly to seafood flavor (Deng et al., 2014)

One of the important factors that determine the rate of flavor compound identification is extraction method, including its extraction temperatures beside samples preparation. The most common extraction method used for volatile flavor compounds nowadays is Solid Phase Micro Extraction (Guillen and Errecalde, 2002), where sample is heated on certain time and temperatures and then the compounds that evaporate from the samples are absorbed in a specific fiber. The effectiveness of extraction temperature would be different for each samples type and this will affect the detected compounds by Gas Chromatography/Mass Spectrometry. Research concerning optimization and method of extraction which suitable for fishery commodities are still rarely found here in Indonesia and it would still need more research regarding the suitability of said method with samples characteristics to detect optimal amount of volatile compound from fishery samples.

The volatile changes of fisheries samples have been well investigated abroad, but there is lack of data about how the steaming treatments may affect the volatile compounds in shrimp samples. In many other countries such as Japan, China and Scandinavian countries, such research on volatile compounds identification have been done many times and for quite a long time, with fishery commodities samples such as sea bream, black bream, rainbow trout, carp, pond smelt, loach and silver carp, squid (Morita et al., 2003; Guillen & Errecalde, 2002; Alasalvar et al., 2005; Liu et al., 2009; Deng et al., 2014). To our best knowledge, there was still no comprehensive study here in Indonesia that has been conducted in investigating the volatiles components in fresh and steamed vaname shrimp.

As mention above, the optimal extraction method, period and temperature would affect the amount of volatile compounds identified by Gas Chromatography/Mass Spectrometry. This research is focused in extraction temperatures considering there are still many temperatures variation found on many research regarding volatile flavor compounds on fishery commodities. Several research which identify volatile compounds on various samples and using different extraction temperatures were Ganeko et al. (2008) and Miyasaki et al. (2011) were using 40^{o}C as the extraction temperatures with fresh sea water fish as their samples; Liebich et al. (1972) was using 55^{o}C as its extraction temperatures with beef samples; Liu et al. (2009) and Guillen & Errecalde (2002) were using 50^{o}C as the extraction temperatures with fresh and steamed freshwater fish, and sea water fish as its samples; Linder & Ackman (2002) and Wierda et al. (2006) were using 60^{o}C extraction temperatures with clam

meat and fresh salmon as their samples; Mansur et al. (2002) was using 70°C with various processed fisheries product.

Based on research mention above, it can be concluded that processed samples were using a higher temperatures compares with the fresh one. It can be assumed that this was caused by different material characteristics between fresh and processed samples which had undergone a series of processing steps such as heating so that it needs higher temperatures on its initial extraction. With this temperature it can be expected that more compounds would evaporate. The result of this research could provide important information concerning optimum extraction method and flavor composition on one of the local fishery commodity considering the basic research concerning fisheries flavor characteristics are rarely found in Indonesia. Therefore the identification of volatile flavor composition of one of the popular shrimp samples is important to carry out. The objective of this research is to identify flavor composition particularly volatiles compounds one on fresh and steamed Vaname shrimp samples.

RESEARCH METHOD

The samples were taken from Karangsong fish landing site, Indramayu District, West Java, Indonesia. Samples preparations were carried out at Fisheries Product Processing Laboratory, Fisheries and Marine Sciences Faculty, Padjadjaran University. Proximate analyses were carried out at Inter-University Centre Laboratory, Bogor Agriculture Institute. Amino acid profile analyses were carried out at Integrated Laboratory, Bogor Agriculture Institute and volatile compounds analysis were carried out at Flavor Laboratory, Rice Research Centre Office, Sukamandi, Subang.

This research were divided into several phase, the first one is Vaname shrimp sampling from Karangsong, Indramayu. As much as 3 kg fresh Vaname shrimp samples were put in a cool box which contain bulk ice and were transported to Fisheries Product Processing Laboratory for preparation.

Second phase is samples preparation and packaging. The shrimp samples were then cleaned and weighed before divided into two groups. One group is fresh vaname shrimp and the other group was steamed first in 100°C (minimum) for 30 minutes (Pratama et al., 2013). All groups were then packed into three different packaging (aluminum foil, cling wrap and as a tertiary packaging is zip-lock plastic bag) with labels. The purpose of three layered packaging is to minimize the changes and degradation to the samples that could be caused by environmental factors such as air, light and temperatures (Pratama, 2011). Samples that have been finished through packaging step were then put into cool box which contain ice and then transported to different laboratories to perform several analysis.

The proximate analysis that were carried out for the fresh and steamed shrimp samples, consists of moisture content analysis, ash content, protein content, and lipid content based on AOAC (2005) procedures. Amino acids profile analysis were carried out based on modification from Ishida et al. (1987) and Toppe et al. (2007) using High Performance Liquid Chromatography (HPLC) (Shimadzu CBM-20A, Shimadzu Corporation, Japan) with fluorescence detector. The obtained results from proximate analysis samples were calculated and showed as means value and its deviation standards and then were discussed descriptively. The amino acids profile results was identified using 15 standards of amino acids and quantified in µmol concentration unit based on their peak areas and amino acids standards peak areas.

Volatiles compound analyses that were carried out were a modification from procedures that were done by Guillen & Errecalde (2002). The analyses were carried out using a set of waterbath, Gas Chromatography (GC) (Agilent Technologies 7890A GC System) and Mass Spectrometry (MS) apparatus (Agilent Technologies 5975C Inert XL EI CI/MSD). Extraction method was done by Headspace Solid Phase Micro Extraction (HS/SPME) using DVB/Carboxen/Poly Dimethyl Siloxane fiber. Extraction time on waterbath that were used was 35°C for fresh samples and 70°C for steamed samples for 45 minutes. GC column used was HP-5MS (30 m x 250 µm x 0.25 µm), helium carrier gas,

initial temperatures was 45°C (hold 2 minutes), temperatures escalation as much as 6°C/minutes, final device temperatures 250°C (hold 5 minutes) with overall time 41.17 minutes. Mass spectrums that were detected were then compared with mass spectrum pattern which were available in computer database or NIST (National Institute of Standard and Technology) library 0.5a version. The data then were further analyzed with Automatic Mass Spectral Deconvolution and Identification System (AMDIS) software (Mallard & Reed, 1997). The resulting data from volatile compounds analysis were discussed descriptively based on identification and semi quantification intensity of the compounds detected from analyzed samples.

RESULTS AND DISCUSSION

Proximate Analysis

Proximate analysis results are useful in studying the nutritive values and their changes in samples. The moisture content, ash, protein and lipid content of fresh and steamed vaname shrimp samples were analyzed in this proximate analysis and the results are shown in Table 1. Moisture content analysis showed that there were differences in moisture contents amount between fresh and steamed samples. Fresh shrimp samples had a slight higher moisture content compared with the steamed one (77.59%; 69.84%). These differences on moisture contents could be affected by the type of commodities tested and processing process that the samples have been through (Pratama 2011; Pratama et al., 2013). Processing step such as steaming according to Fellow (2000) could lead to moisture content loss from inter-cellular spaces in the samples. This matter could lead to lower measurement of steamed samples moisture content compared to the fresh one.

Table 1. Vaname shrimp samples proximate analysis results (%)

Parameters	Fresh	Steamed
Moisture	77.59±0.09	69.84±0.02
Ash	1.38±0.08	1.52±0.01
Protein	19.25±0.23	26.63±0.05
Lipid	0.30±0.01	0.82±0.00

A slight rising in steamed shrimp samples ash content also showed in this analysis compared to fresh one (1.52%; 1.38%). This measurement was mostly dependent on individual mineral contents of each sample. Ash content measured is representing the amount of total mineral of samples tested and also generally also showed inorganic substances that presents in samples which were the residue from high temperatures burning of organic samples. Ash content in fishery commodities could be affected by commodities species, growth phase, feed consumed and various environmental factors (Pratama, 2011; Pratama et al., 2013). Shrimp meat is a good source of minerals and Mg was the dominant mineral in white shrimp meat (Sriket et al., 2007).

Lipid content analysis showed that steamed samples has a slight higher amount of total lipids compared to the fresh one (0.82%; 0.30%). The differences in lipid content between samples could be resulted from the changes of samples moisture content measured. As moisture content loss become higher during steaming process then lipid content measured in proximate analysis would become higher also. The variation showed on samples lipid content measurement could be affected by habitat, seasons, feed source, activity and growth phase of the samples tested (Bligh et al., 1988; Doe, 1998). Shrimp muscle consist of highly unsaturated fatty acids such as eicosapentanoic and docosahexaenoic acids which considered as essential. Lipids from white shrimp meat had phospolipids as the major component (72-74%) and its high free fatty acids content suggested that lipid from white shrimp would be more susceptible to hydrolysis (Sriket et al., 2007).

Protein content analysis showed that steamed samples has a higher amount of total protein compared to the fresh samples (26.63%; 19.25%). Protein content in each samples analyzed would be affected by shrimp habitat, seasons, storage time and condition and also processing methods.

Processing method such as steaming could affect the changes on protein properties in steamed material although the effect was not as severe as other high temperatures processing methods. (Pratama et al., 2013). Moisture content inside the samples would also have a major effect on protein content measured in samples (Sebranek, 2009). Lower moisture content in samples will resulted in higher protein content measured. Similar results were experienced on Puwastien et al. (1999) research on proximate composition of raw and cooked various Thai freshwater and marine fish, higher lipid and protein content were measured in fish with various drying treatment compared to the raw one.

Amino Acids Profile

The purpose of general amino acids composition analysis that had been done in this research besides gaining valuable information in essential and non-essential amino acids was to give an overall description and representation regarding amino acids effect on fresh and steamed shrimp samples flavor characteristics. More specific and satisfying result regarding nonvolatile flavor, could be obtain by performing other type of identification analysis such as free amino acids composition, nucleotides and peptides which are more directly affecting the taste characteristics of a material or product. This research used 15 amino acids standards to quantify individual amino acids in samples, those standards are aspartic acid, glutamic acid, serine, histidine, glycine, threonine, arginine, alanine, tyrosine, methionine, valine, phenylalanine, leucine, lysine and isoleucine. Amino acids composition in shrimp were usually different between species (Sriket et al., 2007). The fresh and steamed shrimp samples amino acids composition are showed in Table 2.

Table 2. Vaname shrimp samples amino acids profile results (%)

Amino Acids	Percentage (%)	
	Fresh	Steamed
Aspartic acid	1.76	2.83
Glutamic acid	3.08	4.70
Serine	0.67	1.07
Histidine*	0.35	0.55
Glycine	1.58	2.23
Threonine*	0.62	0.96
Arginine	1.53	2.69
Alanine	1.11	1.63
Tyrosine	0.71	1.00
Methionine*	0.56	0.72
Valine*	0.87	1.34
Phenylalanine*	0.89	1.38
Isoleucine*	0.86	1.37
Leucine*	1.43	2.21
Lysine*	1.56	2.63

*) essential amino acids

The amount of amino acids detected on fresh and steamed shrimp samples were varied and overall it can be seen from Table 2 that the steamed shrimp samples had a higher amount percentage of amino acids. This could occur due to steamed samples had been through heating process by steaming, and could resulting in amino acids forming from protein thermal degradation. Similar results on amino acids content were reported by Deng et al. (2015) with drying treatment on fresh and dried squid samples.

The highest amount of amino acids detected in fresh and steamed vaname shrimp was glutamic acid (3.08%; 4.70% respectively) a non-essential amino acids which affect products “umami” taste. Next highest amount of amino acids on fresh and steamed samples were aspartic acids (1.76%; 2.83%), arginine (1.53%; 2.69%), lysine (1.56%; 2.63%); glycine (1.58%; 2.23%) and leucine (1.43%;

2.21%). Leucine and lysine are categorized as essential amino acids on the account of that human body could not produce essential amino acids by itself and have to be consumed from various food sources. Similar results were found in Yanar & Celik (2006) research which showed the most abundant amino acids in green tiger shrimp and speckled shrimp and they were glutamic acid, aspartic acid, arginine, lysine and leucine.

Winarno (2008) stated that chemical substances, temperatures, concentration and interaction with other components could affect taste characteristics of a product. Among the compounds that actively affect taste of fisheries commodities are free amino acids, organic acids, quarternary ammonium base, nucleotides and minerals (Doe, 1998; Sriket et al., 2007). According to Pratama et al. (2013), free amino acids forming are influenced by processing parameters, storage, samples species and freshness level of raw material used. Toth & Potthast (1984) and Liu et al. (2009) stated that proteolitic reaction that occurred during heating process could cause free amino acids forming to increase.

Kato et al. (1989) stated that, glutamic acids that was detected in all samples, contributed in umami taste appearance, while proline contributes in giving sweet and bitter taste, glycine and alanine contribute to sweet taste and had a synergetic effect with glutamic acids if present in a compounds mixture. High content of free arginine in crustaceans enriches the sweet taste and yields a seafood-like flavor. Glycine, alanine, serine and threonine taste sweet, while arginine, leucine, valine, methionine, phenylalanine, histidine and isoleucine give bitter taste. Alanine proline and serine contribute to the acceptability of prawns and lobsters. (Sriket et al., 2007). According to Kawai et al. (2009), the amino acids that are present in a product played an important role on taste to most of the foodstuff products. Taste quality from some amino acids, which are protein structural basic units, would depend on the structure of their amino acids side chain.

Volatile Flavor Compounds

Volatile compounds analysis showed that steamed shrimp samples has higher quantity of volatile compounds and the type of the compounds are more vary compared compounds that were identified from fresh shrimp samples. Although different extraction temperatures were applied in this research, the same occurrence are also experienced if the same extraction temperatures that were applied between fresh and steamed samples (Liu et al., 2009; Pratama et al., 2013). The reason in applying two different extraction temperatures was based on the characteristics differences between fresh and heated raw material, so the volatile compounds which contained and present in steamed samples would need higher extraction temperatures compared to the fresh one, with expectation that more volatiles compounds would evaporate and so more volatiles compounds could be detected.

Volatile compounds analysis result from fresh vaname shrimp samples using GC/MS successfully detected as much as 19 volatile compounds which then were categorized into several groups such as hydrocarbon, aldehydes, alcohols, ketones and others. Aliphatic, cyclic and aromatics hydrocarbons (6 compounds) is the highest in quantity of fresh shrimp samples volatiles compounds with Naphthalene, 1-Nonadecene and Limonene as the most abundant compounds present (48.166%; 14.748%; 14.408% respectively). Naphthalene most certain did not derive originally from shrimp samples, for the reason that this compounds is usually produced from plant material degradation, pyrolitic involving phenylalanine and pollutant (Chung et al., 2002; Linder & Ackman 2002).

In addition to hydrocarbons, the analysis were also detecting aldehydes group (5 compounds) with hexadecanal that has the highest proportion, alcohols (3 compounds) with 2-ethyl-1-hexanol has the highest proportion, ketones (4 compounds) with 2-heptanone has the highest proportion. The analysis was also detected one ester compounds, oxalicacid-isobutyl nonyl ester which rarely found on fresh fishery commodities samples and need more rigorous identification. Presumably, ester group compounds that were found in fish samples, are derive from acids and alcohols esterification which previously formed from lipid metabolism. Ester could also derive from lipids thermal degradation products (Guillen & Errecalde, 2002; Chung et al., 2002). The volatile compounds analyses are shown in Table 3 with their proportions sorted from highest to lowest abundance.

Table 3. Volatile compounds detected in fresh vaname shrimp samples

RT	Compounds	Area	Proportion (%)
	Hydrocarbons (aliphatic, cyclic, aromatics)		
11.05	Naphthalene	2806220	48.166
7.2891	1-Nonadecene	859270	14.748
7.2891	Limonene	839460	14.408
21.8372	Hexadecane	375975	6.453
7.2968	Cyclohexene, 1-methyl-4-(1-methylethenyl)-, (S)-	230676	3.959
9.0925	Undecane	35036	0.601
	Aldehydes		
7.3127	Hexadecanal	183992	3.158
9.1917	Nonanal	48261	0.828
23.9311	Octanal	16077	0.276
11.6392	2-Octenal, (E)-	4768	0.082
11.6327	Dodecanal	3585	0.062
	Alcohols		
7.432	1-Hexanol, 2-ethyl-	29969	0.514
9.4686	1-Octen-3-ol	20236	0.347
7.4485	1-Penten-3-ol	9831	0.169
	Ketones		
8.9131	2-Heptanone	115256	1.978
6.3387	5-Hepten-2-one, 6-methyl-	45194	0.776
8.9125	2-Decanone	23707	0.407
15.1865	2,3-Pentanedione	4683	0.080
	Others		
13.299	Oxalic acid, isobutyl nonyl ester	173969	2.986

Volatiles flavor compounds identification analysis on steamed vaname shrimp samples successfully detected as much as 58 volatiles compounds which were categorized into several groups such as hydrocarbons, aldehydes, alcohols, ketones and others. Hydrocarbons group has the highest quantity in this steamed samples with 21 compounds detected and pentadecane has the highest proportion (25.109%), followed by aldehydes group (17 compounds with 11.912% hexadecanal that has the highest proportion), alcohols (11 compounds with 6.318% 2-nonanol has the highest proportion) and ketones (4 compounds, with 2.354% 2-decanone has the highest proportion). The last group is various compounds detected that were categorized to other group, due to they were uncommon being detected in this type of samples or they could be contaminant from polluted samples water environment. Many of those compounds are presents in low proportion and they will need further investigation. Volatile compounds composition that were detected from steamed vaname shrimp samples can be seen on Table 4 with their proportions sorted from highest to lowest abundance.

Table 4. Volatile compounds detected in steamed vaname shrimp samples

RT	Compounds	Area	Proportion (%)
	Hydrocarbons (aliphatic, cyclic, aromatics)		
18.0211	Pentadecane	13172209	25.109
21.829	Heptadecane	3591905	6.847
13.293	E-1,6-Undecadiene	1565074	2.983
19.9763	Hexadecane	1530827	2.918
22.142	1,12-Tridecadiene	1346017	2.566
15.95	Tetradecane	1260532	2.403
25.631	3-Octyne, 6-methyl-	461328	0.879
17.862	1-Pentadecene	436771	0.833
17.614	Cyclododecane	323516	0.617
23.6068	Nonadecane	275160	0.525
2.1406	Toluene	206141	0.393
21.7083	1-Nonadecene	167880	0.320
25.2987	Tetradecane	99903	0.190
11.4637	Dodecane	90449	0.172
8.7169	Cyclohexene, 1-methyl-4-(1-methylethenyl)-, (S)-	88621	0.169
	1,3,6-Heptatriene, 5-methyl-		
13.3687	Tridecane	69135	0.132
13.7707	Limonene	67833	0.129
7.2659	Undecane	65671	0.125
9.0953	Naphthalene, decahydro-	47039	0.090
13.429	Cyclopentadecane	46643	0.089
17.732		32650	0.062
	Aldehydes		
23.9203	Hexadecanal	6249017	11.912
9.2028	Nonanal	3214660	6.128
6.1183	2-Octenal, (E)-	1208237	2.303
2.5675	Pentanal	789994	1.506
4.3727	Heptanal	669560	1.276
8.5162	2,4-Heptadienal, (E,E)-	569203	1.085
20.2502	Tetradecanal	519815	0.991
11.639	Decanal	462741	0.882
5.1118	Benzaldehyde, 4-ethyl-	353140	0.673
27.2616	Dodecanal	327412	0.624
2.5456	Hexanal	299736	0.571
23.276	4-Pentenal, 2,2-dimethyl-	256890	0.490
29.5863	2-Undecenal	176237	0.336
11.0216	2,4-Hexadienal, (E,E)-	53560	0.102
18.3163	2-Nonenal, (E)-	32257	0.061
13.4301	Tridecanal	22781	0.043
29.0367	2-Hexenal, (E)-	3418	0.007
	Alcohols		
9.2063	2-Nonanol	3314585	6.318
21.452	Z-10-Pentadecen-1-ol	1248836	2.381
6.2977	1-Octen-3-ol	1079699	2.058
13.151	10-Undecyn-1-ol	696974	1.329

RT	Compounds	Area	Proportion (%)
15.7844	1-Octanol	189957	0.362
8.433	2-Octen-1-ol	121741	0.232
19.834	1-Nonanol	93602	0.178
7.4766	1-Hexanol, 2-ethyl-	50691	0.097
5.2163	1-Penten-3-ol	38972	0.074
2.2233	1-Pentanol	8334	0.016
19.1186	1-Hexanol	5041	0.010
	Ketones		
8.92	2-Decanone	1234892	2.354
6.3444	5-Hepten-2-one, 6-methyl-	307024	0.585
15.8788	2-Heptanone	38451	0.073
21.3034	2,3-Pentanedione	3138	0.006
	Others		
6.788	Phenol	3118707	5.945
17.071	Isopulegol acetate	465432	0.887
19.261	3-Methyl-5-hydroxy-isoxazole	138751	0.264
14.474	5H-1-Pyrindine	98695	0.188
6.4158	Furan, 2-pentyl-	53450	0.102

Various volatiles compounds that have been detected on both types of samples were derive from shrimp samples constituents such as chemicals composition that were analyzed mainly proteins and lipids, so that the variety of quantities and types of those volatile compounds are related to types variation and quantities of samples chemical composition. Most of those volatile compounds which affect commodities aroma derived from the results of enzymatic reactions, microorganism activities, lipid auto oxidation, resulting substance from various thermal involved reactions and environmental impacts (Alasavar et al., 2015). In general, it can be assumed that if fresh and steamed samples from fishery commodities had their volatile compounds analyzed then the steamed samples would have a greater number of volatile compounds detected compared to the fresh one as point out by Pratama et al. (2013) and Liu et al. (2009). These could occurred as a result of the forming of more volatile compounds in account of heating process, thermal oxidation and fatty acids decomposition (Liu et al., 2009). Other factors that affect the quantity and types of compounds detected in this volatile compounds analysis were extraction method, type of samples and GC/MS column and running parameters (Pratama et al., 2013).

As mention above, most of the detected compound group came from and could be categorized into several groups which were hydrocarbons, aldehydes, alcohols, ketones and their derivatives. Volatile compounds that came from hydrocarbon groups could derive from decarboxylation reaction and the splitting process of fatty acids carbon chains, secondary reaction from carotenoid (if present) and other unsaturated fatty acids thermal oxidations (Chung et al., 2002; Linder & Ackman, 2002; Liu et al., 2009). Aldehydes group compounds detected could derived from fatty acids carbon double bonds oxidation whether they were saturated or unsaturated (Sakakibara et al., 1988; Cha et al., 1992; Guillen & Errecalde, 2002; Linder & Ackman 2002; Guillen et al., 2006; Liu et al., 2009). Alcohols, aldehydes and ketones groups volatiles compounds detected, were also could formed as a result of lipid and fatty acids oxidations and amino acids degradation that occurred during processing (Yajima et al., 1983; Sakakibara et al., 1990; Ho & Chen, 1994). Almost all reaction that could generate or produce volatiles compounds would involve saturated and unsaturated fatty acids which in general were abundantly contained in most of fishery commodities. According to Mall & Schieberle (2016), aroma compounds odorants of heated crustacean meat that were detected consist of marine, leather-

like and dry seaweed-like and raw prawn meat was mainly dominated by metallic, cucumber-like, green and fishy notes.

Some of the hydrocarbons, aldehydes, alcohols and ketones groups which detected in shrimp samples such as limonene, naphthalene, hexadecane, nonadecane, tridecane, dodecane, 1-nonadecene, toluene, nonanal, hexadecanal, pentanal, heptanal, 1-octen-3-ol, 1-nonanol, 1-hexanol, 2-ethyl-1-hexanol, 2-heptanone, 2-decanone were also known being detected in raw, cooked and recooked silver carp (Liu et al., 2009), wild and cultured sea bream (Alasalvar et al., 2005) and raw black bream (Guillen & Errecalde, 2002).

CONCLUSION

The differences showed on proximate composition results from fresh and steamed vaname shrimp samples are depending on the initial chemical composition of the samples and heating process that had been through which was steaming. Moisture loss during heating would also become an important factor which affects other samples content measured. Amino acids analysis showed that the steamed shrimp samples had a higher amount percentage of amino acids and this could be affected by proteolitic reaction that occurred during heating process. Glutamic acid had the highest quantity compared to other 14 amino acids on fresh and steamed samples (3.08%; 4.70%) and this non-essential amino acids has an impact in providing and contributes to “umami” taste of the product. Volatile compounds analysis showed that most of the detected compounds group came from and could be categorized into several groups which were hydrocarbons, aldehydes, alcohols, ketones and their derivatives. As much as 19 volatile compounds were detected on fresh samples and 58 compounds were detected from steamed samples. The most abundant compounds groups in both samples are aliphatic, cyclic and aromatic hydrocarbons which could be derived from decarboxylation reaction and the splitting process of fatty acids carbon chains, secondary reaction from unsaturated fatty acids thermal oxidations. The volatiles components composition data are useful for various more advance research in flavor field of study. The data can be used for local product flavor composition mapping, identification of key aroma or key characteristics compounds from certain products, identifying compounds that affect off-flavor from a product and provide basic information in making a specific flavor extract. In Indonesia particularly there were still a lot of commodities that have not been known regarding their flavor composition and more research on the optimization of extraction and identification method is still required to ensure the maximum detection of volatiles compounds.

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TALAS BANTEN (Xanthosoma undipes K.Koch), ITS POTENTIALITY FOR INDONESIA'S FOOD SECURITY AND FOOD INDUSTRY

[1,2,3*)] Fetriyuna F, [2)] Dwiyanti R, [2)] Pratiwi R.L, [2)] Karnadhi Y.J, [2)] Putri Y.Y, [1,3)] H.K.Biesalski

[1)] Institute of Biological Chemistry and Nutrition, University of Hohenheim, Stuttgart, Germany,
[2)] Faculty of Agro-Industrial Technology, Padjadjaran University, Bandung, Indonesia
[3)] Food Security Center, University of Hohenheim, Stuttgart, Germany

[*)] Correspondence e-mail : fetriyuna@unpad.ac.id; fetriyuna@uni-hohenheim.de

Abstract

Talas Banten (Xanthosoma undipes K. Koch) or Taro, is an indigenous food resource which underutilized from Banten province, Indonesia. Taro corm content approximately about 3415 kcal/kg and potentially be used as an alternative to several food products and for substitute rice as a staple food to ensure food security. Taro also contains 15.21% (wb) of starch. Native starch has several shortcomings such as low viscosity, not resistant to acid treatment, sticky properties, and hard paste formation. That limitation needs to be overcome by physical and chemical modification to meet industrial needs. This research was conducted to investigated nutrition content of taro flour and starch as well to evaluate the effect of modification techniques of steam pressure, heat moisture, and acetylation treatments. Result found that different methods showed different results in functional properties (swelling volume, water absorption capacity, whiteness degree, freeze-thaw stability, solubility and gel strength) as well as amylography characteristics. Modification techniques should be adjusted according to production purposes. Talas Banten could be potentially developed to meet the needs of ensuring food security as well food industry.

Keywords : talas banten, taro, food security, modification starch, amylography characteristics.

INTRODUCTION

The ability of food production in Indonesia is limited while there are increasing of national food needs. Various alternatives have been promoted in order to meet the increase of food demands by growing the productivity cultivation of food by using the technology and diversification. Increase by the carbohydrate needs cannot be provided just from cereal, so it is necessary to find and maximize carbohydrate production from tuber plants. As a tropical country, Indonesia has abundant resources of tuber crops which underutilized, so that is important to find out the potentiality and maximize the resources.

Talas Banten (Xanthosoma undipes K. Koch) or also known as taro beneng (large and yellow) has large edible parts in the form of tubers (Haliza, Kailaku, and Yuliani, 2012). The center of taro cultivation is in Juhut, Pandeglang Regency of Banten Province, Indonesia with an area of about 70 hectares. This plant has a tuber that can reach the weight of 20 kg at the age of 2 years. Talas Banten has a protein content of 2.01%, carbohydrates 18.30%, starch 15.21%, crude fiber 0.73%, and crude fat 0.27% (BPTP Banten, 2011). The dimension of this taro species respectively: length 5 - 7 cm, diameter 7 - 8 cm, weight 64.65 g, the color of the tuber is yellowish white.

The tuber of taro has a short period of shelf life due to their high moisture content; however, the shelf-life can be improved by processing the fresh tuber into flour and/or starch. Because of the lack of knowledge about functional properties, Taro starch is not yet used as a commercial product.

To produce taro flour, there are several steps: peeling, washing, slicing, soaking in salt dilution, drying and then grinding. The powder characteristics: moisture content 5.61% and this number already fulfill the Indonesia National requirement for flour which maximum 14%. Fat and protein content in this

flour is low, which is useful to provide the characteristic of product with an appropriate temperature of gelatinization and crunchy texture since the limitation of protein. The promising content of taro flour is carbohydrate is around 89.23% which potential to develop for various kinds of products include wet, semi-wet, and dry products.

Taro starch can be used in the processed food industry as an ingredient in the food processing. However, in general, natural starch has a shortage that often inhibits its application in the food processing. Native starch has a limitation of and inconsistent viscosity and gel-forming ability, not resistant to high-temperature heating, acid conditions and mechanical processes, limited solubility in water, and easy to experience syneresis due to the occurrence of starch retrogradation (Kusnandar, 2010).

Native starches have limited use in industrial applications due to their poor water resistance, pasting and mechanical properties. These behaviors can be amended by altering the starch structure by various methods of modifications (Sherestha and Halley, 2014). Structural modifications tend to stabilize the starch granules, impart hydrophilicity or hydrophobicity, heat resistance, desirable rheological properties, and increased processability so as to be suitable for specific industrial applications. Physical modifications on starch can be achieved by various drying techniques, treatment with acids and alcohols, extrusion, heat, and moisture, etc. On the other hand, chemical modification can be achieved by chemical reaction, e.g. conservation, oxidation, dextrinization, cross-linking and stabilization of starches.

Nowadays food industry needs various types and characteristics of the raw material to provide a healthy food, acceptable by the consumer and have a long shelf life during production, distribution, and consumption. To meet the entire industrial requirement, there must be a modification on native starch whether chemical, physical or combination method. Starch modification with physical/hydrothermal treatment will produce modified starch with a high number of SDS and RS (slowly digestible starch and resistant starch) which has a health benefit for consumers.

Modification of starch is carried out to enhance the positive attributes and eliminate the shortcomings of the native starches. Modification of starch is an ever-evolving industry with numerous possibilities to generate novel starches which include new functional and value-added properties as a result of modification and as demanded by the industry (Kaur *et. al.* 2012*)*.

Starch modification technique is necessary to produce specific physicochemical characteristics according to the desired product characteristics. Modified starch products can be utilized both as a major component as well as food additives in food ingredient corridors. Products such as derivative products, encapsulation matrices, texturizers, stabilizers, emulsifiers, sweeteners, fat replacers, thickening agents, and fillers are part of food ingredients that can be developed on a modified starch (Herawati, 2011).

Starch Modification classified as chemically and physically technique. Chemical modification using crosslinking and/or acetylation techniques, while physical modification using heat-moisture treatment (HMT) and steam pressure treatments (SPT) methods. Both of techniques will come up with different characteristics and supposed to be adjustable based on the purpose of uses. Modification of the HMT method was reported to improve heat resistance, mechanical treatment and acidic pH (Taggart, 2004), increasing the temperature of gelatinization and stability of the starch paste (Hormdok, 2007). Acetylation modification starch has advantages that are more resistant to retrogradation, low syneresis, stable viscosity at low temperature (Xie, Liu, and Cui, 2005).

Modified Starch

Modified starch is a starch given a particular treatment to produce better properties, repair or alter some other properties or is a starch whose hydroxyl groups have been altered through chemical reactions (esterification or oxidation) or by disrupting their original structure. Such treatments include the use of heat, alkaline acids, oxidizing agents, or other chemicals that will produce new chemical groups or changes in shape, size, and molecular structure (Glicksman (1969) *cited by* Richana and Chandra (2004)).

Starch will increase its economic value if modified through physical, chemical or combination of both. Modified starch is a starch that has undergone a controlled physical or chemical treatment that changes one or more of its original properties, such as the initial temperature of gelatinization, characteristics during the gelatinization process, resistance by heating, acidification, and agitation, and retrograde tendency. Changes that can occur at the molecular level with or without changing the appearance of the granule of the stool. (Pomeranz, 1985).

Starch modification techniques can be done physically, chemically, or enzymatically. Physical modifications include pra-gelatinization process, particle size adjustment and moisture adjustment, extrusion, parboiling, steam-cooking, microwave irradiation, roasting, hydrothermal treatment, and autoclaving (Sajilat, Singhal, and Kulkarni, 2006). Each modification method produces modified starch with different properties as desired.

A. Heat Moisture Treatment (HMT)

The HMT method is carried out by heating the starch above the temperature of gelatinization but the water content is limited so that the starch is not gelatinized but only undergoes changes in molecular conformation accompanied by changes in its characteristics (Collado and Corke, 1999; Pukkahuta C, Suwannwat B, Shobsngob S, and Varavinit S., 2007). The HMT technique resulted in the expanding amorphous starch area, then pressed out of the crystallized area resulting in damage and melting of the starch-crystallized area of the starch granules, resulting in a more stable stability of the starch granules (Manuel, 1996).

B. Steam Pressure Treatment (SPT)

The method of steam pressure treatment is a physical modification of starch by using steam with high temperature and pressure then continued by oven drying. Water content, starch type, temperature, and time affect the process of modification.

Administration of steam pressurization treatment on starch will decrease viscosity and breakdown. The decreased breakdown is desirable because it can decrease the cohesiveness of the starch paste. Steam pressure treatment results in decreased viscosity and breakdown by strengthening the association bond between the starch molecules in the granules. This causes a decrease in swelling of the granules and heat and shear stress. Processed food products with starch treated with heat-moisture treatment and steam pressure treatment were found to be superior in texture (Moorthy, 1999).

C. Acetylation (AST)

Acetylation is a modification of starch by the addition of a reagent so that an acetyl group which replaces the OH-group by acetylation reaction is obtained. With the replacement of the cluster, the strength of the hydrogen bonds between the starch decreases and causes the starch granules to become more fluid (much water-holding), easily soluble in water, and increases the freeze-thaw stability of starch (Adebowale et al., 2005; Singh and Singh, 2004).

Jarowenko (1989) states that the choice of acetylation method, reagent, type of starch used for acetylation depends on the desired product and adjusted its use. The parameters of the acetylated starch are indicated by the Degree of Substitution (DS) value. The degree of substitution (DS) shows the substitution rate of the acetyl group substitution of the -OH group per anhydroglucose unit in the starch molecule. The value of the DS ranges from 0.01 to 3 if the value of 0.01 means there is one acetyl group per 100 molecules of glucose whereas if the value of DS of 3 means there are 300 acetyl groups per 100 molecules of glucose or in other words each -OH group substituted with acetyl groups (Belitz, Grosch, and Schieberl, 1987).

Low density acetylated starch acetylated starch grades ranging from 0.01 to 0.1 is a type of starch widely used in the food industry because it has physicochemical properties such as low gelatinization temperature, high solubility, and stable on cooking and low-temperature storage (Saartrat, et al, 2004).

Indonesia has promulgated the National instructions to ensure food security and food sovereignty through the regulation of Acceleration Food Diversification (*Percepatan Penganekaragaman Konsumsi Pangan* (P2KP) and the President Regulation No. 22 of 2009 about Acceleration of Food Diversification through Strengthening Indigenous Food Product. The exploiting of talas banten is suitable to program of Indonesia government in food diversification using local food commodity and improve food security in Indonesia, especially in Banten province.

The purpose of this research is to know the chemical composition of taro flour and the modified taro starch (Xanthosoma undipes K. Koch). The results of this study are expected to provide a further information about the potentiality or talas banten /taro to be used as a substitute for rice as a staple food in Indonesia by knowing their nutritional composition and possibilities to processed into various products. The information about modified taro starch (Xanthosoma undipes K. Koch) is beneficial to the food processing industry that can be used as the basic utilization of taro starch.

RESEARCH METHOD

Starch Production

The material used in this research is Talas Banten/Taro (Xanthosoma undipes K. Koch) with 8 months harvest age obtained in Juhut, Pandeglang, Banten. In detail the stage of making taro starch is as follows : Peeling, Washing, Sizing with 8-10 mm slice thickness, Soaking taro slices (NaCl 10% t = 120 minutes), Destruction, Screening, Centrifugation, Drying, Milling, Sifting using 100 mesh sieve.

The research method used is the experimental method with descriptive analysis (explanatory research) and continued with regression and correlation test using several models that explain the relationship between independent variables and dependent variables. The observed variables include functional characteristics, swelling volume, solubility, water absorption capacity, freeze-thaw stability, moisture content, white degree and amylographic properties including gelatinization initial temperature, peak viscosity (PV), hot paste viscosity or hold viscosity (HV), viscosity changes during heating or breakdown, cold paste viscosity or final viscosity (FV), changes in viscosity during cooling or setback.

Starch Modification

1. *Heat Moisture Treatment (HMT)*

The modified taro starch is made by the process of controlling the moisture content (27% ± 1), balancing the moisture content in the refrigerator (T = 4-5 ^{o}C t = overnight), heating at a certain temperature (T = 110 ^{o}C) and at the time of treatment, 12% ± 2; T = 50 ^{o}C t = 4 hours), sieving (≥100 mesh).

2. *Steam Pressure Treatment (SPT)*

The steam pressure treatment procedure refers to Khomsatin (2011) with modification duration of steam treatment. Stages consist of:

- Adjust moisture content (30% moisture content.)
- Water content Balancing
- The starch is placed in a stainless steel container then wrapped in aluminum foil and left at refrigeration temperature (4 ^{o}C) for 14 hours
- Steaming (T = 121 ^{o}C, P = 1.3 bar)
- Drying (T = 50 ^{o}C to less than 10% moisture content)
- Milling
- Sifting (100 mesh particles.)

3. Heat Treatment (HT)

The heat treatment procedure refers to Khomsatin (2011) which modified the temperature of treatment without pressure. Stages consist of:

- Adjust moisture content (30% moisture content.)
- Water content Balancing

- The starch is placed in a stainless steel container then wrapped in aluminum foil and left at refrigeration temperature (4 ^{o}C) for 14 hours
- Steaming (T = 90, 100, 110, 121 ^{o}C,)
- Drying (T = 50 ^{o}C to less than 10% moisture content)
- Milling
- Sifting (100 mesh particles.)

4. Assetilation (AST)

- Preparation of starch solution (starch and water by 1: 3 (w / v))
- Conditioning pH 8 starch solution using 0.5 N NaOH
- Addition of glacial acetic acid 1% (done as dropwise while stirring for 30 minutes)
- Conditioning pH of starch solution at pH 6 (using HCl 0.2 N)
- Washing of starch solution
- Centrifugation
- Drying (T = 50 ° C t = 24 hours)

RESULT AND DISCUSSION

The result showed that Talas Banten/taro has a high number of carbohydrate especially starch which has the potentiality to be optimized as a food especially as a staple food in Indonesia. The high content of carbohydrate also enable this crops to be processed in various types of product not only as a traditional cuisine but also a modern product.

Table 1. Chemical Composition of Talas Banten (Xanthosoma undipes K. Koch)

Composition	Corm of Taro			Taro Flour
	(% wb)[a]	(% db)[b]	(% db)	(% db)
Moisture (%)	-	80.56	76.9	12.0
Carbohydrate (%)	18.30	7.59	13.87	74.2
Amylose (%)	-	23.9	-	-
Amylopectin (%)	-	76.1	-	-
Crude protein (%)	2.01	5.91	4.8	10.3
Crude fat(%)	0.27	3.88	0.63	1.3
Starch (%)	15.21	-	70.1	70.7
Fiber (%)	0.73	12.07*	3.8	1.0
Ash (%)	-	7.55	3.8	1.2
Energy (Kcal/kg)	-	3415	-	-
Sugar as sucrose 8%)	-	-	12.2	1.6

Sumber: a = BPTP Banten (2011)
b = Fetriyuna, *et al* (2017)

Talas banten/taro also has the high number of fiber which potentially develop as a healthy food not only for people in diet but also for people maintaining their health. This resource could also be processed as a functional food as a prebiotic food to maintain the health of the intestine system.

The mineral content in taro consists of calcium, magnesium, potassium, copper, zinc, manganese and iron. This mineral is essential to combat malnutrition especially hidden hunger which may cause a serious health problem in the early stage of life. The lack of certain mineral in diet will inhibit the growth and development of the certain organ in human body.

By including talas banten/taro in the daily diet, hopefully, not only solve the problem of the source of energy but also as a source of necessary micronutrient. This tuber can be consumed as a row or processed into flour or starch.

The comparison of *amilographic* characteristics of taro flour and taro starch from Talas Banten/Taro (*Xanthosoma undipes* K. Koch) can be shown in Table 2.

Tabel 2. An *Amilographic* Characteristics of Taro Flour and Taro Starch of Talas Banten (Xanthosoma undipes K. Koch)

No.	Parameter	Taro Flour		Taro Starch	
		Viscosity (cP)	Temperature (^{0}C)	Viscosity (cP)	Temperature (^{0}C)
1	*Pasting Point*	53.0	80.70	25.0	83.19
2	*Peak Viscosity*	2668.5	94.63	4316.0	91.43
3	*Hold Viscosity*	1811.5	91.50	2300.0	88.94
4	*Final Viscosity*	2883.0	49.47	3092.5	54.48
5	*Breakdown*	857.0	-	2016.0	-
6	*Setback*	1071.5	-	792.5	-

Tabel 3. Color intensity of Taro Flour and Taro Starch

Sample	L*	a*	b*
Taro Flour	48.61	0.33	2.92
Taro Starch	53.60	0.76	1.04

Starch modification performed in this study include Heat Moisture Treatment (HMT), Steam Pressure Treatment (SPT), Heat Treatment (HT) and Acetylation (AST).

Table 4. An *Amilographic* Characteristic of Modified Starch from Talas Banten/Taro (Xanthosoma undipes K. Koch)

No	Characteristics	Modification Techniques			
		HMT	SPT	HT	AST
1.	Moisture content (%)	-	7,81 - 9,52	7,47 – 10,84	7.31
2.	Water Absorption Capacity (g/g)	1.79 – 1.89	2.75 – 3.76	1.82 – 3.50	1.53
3.	Swelling Volume (ml/g)	8.50 – 14.20	9.13 – 10.75	8.72 – 11.06	19.30
4.	Solubility (%)	6.70 – 18.20	12.30 – 15.97	8.75 – 10.85	12.34
5.	*Freeze Thaw Stability* (%)	29.04 – 43.58	20.60 – 25.03	-	0 – 3.93
6.	Whiteness Degree (%)	80.19 – 81.45	70.17 – 78.19	71.67 – 83.52	84.80
7.	The initial temperature of gelatinization (^{0}C)	81.94 – 83.76	80.86 – 82.29	81.50 - 82.28	78.66
8.	Peak Viscosity (cP)	3899.5-6002.5	3320 - 5698	4710.5 - 5445	4894.5
9.	Hold Viscosity (cP)	1612.5-3280.5	2512 - 3676	2899,7 - 4081.2	1839
10.	Breakdown Viscosity (cP)	1994 - 2722	808.3 - 2021	1296.5 – 2975	3055
11.	Final Viscosity (cP)	2374 –5145.5	4581 - 5871	4856.3-6334.2	2849.5
12.	Setback Viscosity (cP)	761.5 - 1865	2069 - 2194	1956.7-2328.5	1010.5

The temperature of gelatinization of starches isolated from *Xanthosoma undipes* K. Koch is higher than sweet potato (Oktaviani, 2013) and *cannalCanna edulis Ker* (Faridah, 2011) which mean taro starch resistant of heat. Peak viscosity of taro starch is about 4316 cP, lower than sweet potato (Oktaviani, 2013) but higher than *cannalCanna edulis Ker* (Faridah, 2011). Peak viscosity temperature of 91.43^{o}C. *Hold Viscosity* of taro starch is 1811.5 cP in temperature of 49.47 ^{o}C.

Final Viscosity of taro starch is 3092.5 cP which means it easy to build a gel during storage. *Breakdown viscosity of taro starch is about* 2016 cP. It indicates the stabilization after processing into a

product. Some of these characteristics are not yet fulfilled the industry requirement, so the modification is needed to provide such kind of products for industrial purposes.

Based on preliminary research on the properties of native taro starch, obtained the temperature of gelatinization 81.95 ^{o}C, Peak Viscosity 3899.5 cP, Hold Viscosity 1612.5 cP, Final Viscosity 2371.5 cP, Breakdown Viscosity 2287 cP, and Viscosity Setback 761.5 cP. The color of taro flour is yellowish white and for the starch is less yellowish and tend to white.

Moisture content

The value of moisture content of taro SPT and HT modified starch ranged between 7,81-9,52% (wb) and 7,47 - 10,84%, AST modified starch equal to 7,31% (wb) , while natural taro starch is 5.55% (wb). The water content of native taro starch is lower than that of those modified starch. This suggests that the modification of pressurized steam and acetylation may increase the water content of taro starch.

The water content of taro SPT modified starch tends to increase with increasing duration of steam pressurization. Khomsatin (2011) states that pressurized steaming increases the moisture content caused when pressurized steam, starch contact with steam and absorbs the water vapor. Meanwhile, moisture content in the AST modified starch is higher than native starch because during the process of acetylation modification occurs water absorption by starch granules due to the opening of granules due to the addition of NaOH. The open and damaged starch granules will more easily absorb water, causing the resulting starch sediment after modification to contain more water content (Triyani, Ishartani, and Rahadian, 2013).

Water Absorption Capacity

The value of water absorption capacity (KPA) represents the amount of water available for gelatinization (Marta, 2011). The value of water tanning capacity of starch taro starch naturally amounted to 1.15 (g/g db), while the water tap water absorption capacity of all taro modifications showed greater value. This suggests that modification of HMT, SPT, HT, and AST may improve the starch's ability to absorb water.

Adebowale *et al* (2005) state that HMT treatment can increase the water binding capacity of red sorghum starch due to an increase in the tendency of hydrophilic properties in starch as the starch moisture level increases.

The modified capacity of taro starch water uptake tends to increase with increasing duration of pressurized steam. Moorthy (1999) reported that pressurized steaming may increase the level of starch gelatinization produced. When gelatinization process occurs damage of intramolecular hydrogen bond. The hydrogen bonds play a role in maintaining the structure of granular integrity. The presence of free hydroxyl groups will absorb water, resulting in swelling of starch granules. Therefore, the longer the steaming the more the number of hydroxyl groups of starch molecules so that the ability of starch to absorb water is higher. While in SPT and HT modification, water absorption capacity increases due to the amorphous portion of the starch granules become wider and some hydrogen bonds between the amorphous and crystalline parts can be damaged so that the value of KPA increases.

According to Saputro *et al* (2012), the increase in water absorption capacity in AST modified starch compared to native starch is due to the substitution of acetyl groups replacing the hydroxyl groups so that the intermolecular hydrogen bonds in the amorphous regions that stabilize the starch structure become weak and ultimately cause the starch granule structure to become less meeting. This can facilitate access to water in an amorphous area. Singh *et al* (2004) also stated that substitution of acetyl groups in starch weakens hydrogen bonds between molecules-amylose molecules and amylopectin on starch so that water becomes more easily penetrate into starch granules.

Swelling Volume

The value of swelling volume of native taro starch was 14.5 (ml/g). After modification, the swelling volume of HMT modified starch, steam pressing, and heat treatment decreased while taro AST modified starch increased swelling volume.

The decrease in swelling volume of modified starch along with the increase of steaming duration means the longer the steaming process is made, the smaller the ability of taro starch to expand after being heated in excess water at a certain temperature and time.

The decrease in volume swelling is due to the growing interaction between amyloid-amylose, amylose-amylopectin and amylopectin-amylopectin resulting in more rigid starch granules after the hydrothermal process. The decrease in volume swelling is also due to the decrease in the number of free hydroxyl groups available to interact with water molecules so that less water is absorbed. In addition, the alteration of the recrystallization of the starch crystalline portion of the reallocation of the amylose molecule causes the more rigid starch granules to be difficult to inflate.

The process of expansion of starch acetylated modification granules is greater than that of natural starch because more water is absorbed into each starch granule. The acetylation modified starch granules that absorb more water cause increased volume swelling. Marta (2011) explains that the increase in water absorption capacity has a relationship with swelling volume. The greater the value of water absorption capacity, the greater the swelling volume.

Solubility

The solubility value of HMT, SPT, and HT modified taro starch each ranged between 6.70 - 18.20%, 12.3-15.97%, and 8.75 to 10.85%, while native taro starch amounted to 13.02%. This suggests that HMT, SPT, and HT tend to increase the solubility of taro starch. Based on the research results, the solubility of starch decreased at steady pressures 15-20 minutes, then increased again.

Lai (2000) and Khomsatin (2011) reported the solubility of rice flour and corn flour increased after the steaming process. This occurs because of the degradation of amylopectin molecules in the outer linear chain (branch) so that the number of large molecules decreases but there is an increase in the number of smaller amylopectin fragments or amylose that loosens when the starch granules are exposed during the steaming process. Amylose which is a water-soluble starch fraction affects solubility. The more amylose that looses the three open starch granules, the higher the solubility.

The solubility value of starch acetate modified by 12.34% lower than the native starch. This is in accordance with research Saputro, *et al* (2012) which states that the process of AST on taro Banten resulted in decreasing solubility in taro starch. The greater the amount of acetic acid used, the taro starch decreased further. It is caused by the substitution of an acetyl group that replaces the hydroxyl group to form a complex between the amylose bond and the substantially bonded substantially bonded group by covalent bonding. Consequently, water molecules in the starch molecule have resulted in increased swelling volume but prevented the amylose molecule to dissolve in the system (leaching amylose).

Freeze-Thaw Stability

The value of freeze-thaw stability of HMT and SPT modified taro starch respectively ranged between 29.04 -43.58% and 20.60-25.03%, while native taro starch was 19.23%. This suggests that the modification of HMT and SPT increased the value of freeze-thaw stability of taro starch. The longer the pressurized steaming process is performed, the lower the value of freeze-thaw stability means the unstable taro starch in cold storage temperature.

The decrease in the value of freeze-thaw stability is due to the less amylose component that comes out with water (leaching amylose) so the freeze-thaw stability value is lower (Oktaviani, 2013). Retrogradation of starch occurs when starch molecules begin to reassociate forming structures. The starch gel is metastable and nonequilibrium system causing structural changes during storage (Sandhu et al., 2003). Moorthy (1999) reported that the longer the pressurized steam, the lower the total amylose and soluble amylose. Dissolved amylose is distributed in the amorphous portion of starch granules and is very easy to leach in hot water. It shows the steaming changes the granular structure of the starch so that the dissolved amylose molecules are lower.

Meanwhile, the value of freeze-thaw stability of AST modified starch showed the lowest value of only 0-3.93%. These results indicate that acetylation modification provides an excellent low-temperature stabilizer rather than other starch modification.

The size of the acetyl group is greater than that of the hydroxyl group and has a stronger covalent binding than the OH group hirogenous bond so that the presence of this group in the amylose fraction reduces the tendency among amylose molecules to join. This group also provides a charge that results in the rejection of the reflux amylose and amylopectin molecule to minimize retrogradation. Therefore, starch acetylation modification showed better stability at low temperatures (Lawai 2004),

Whiteness Degree

The white degree of HMT, SPT, HAT and AST modified taro starch were respectively 80.19% - 81.45%, 70.17-78.19%, 71.67 - 83.52%, and 84, 80%, while the white degree of native taro starch is 89.9%. The longer the duration of HMT, the length of SPT, and the increase of HT temperature, the degree of white starch content of modified taro is getting lower, which means the color of starch is more brownish. The heating process can cause the starch to experience a non-enzymatic browning reaction of the reducing sugars and proteins present in the starch.

The fluid in cells is rich in sugar and protein content. The process of cell destruction causes the solution in the cell to come out so that the sugar and protein dissolve. Then the component interacts with air and then reacts with oxygen to form a color component. Furthermore, according to Belitz and Groszh (1987) cited by Hapsari et al. (2011), the interaction of amino and monosaccharide components, followed by water release, will form imine intermediary compounds or N glycosides. N-glycosides are the starting product which can then form the Amadori compound (Amadori rearrangement). This compound is an intermediate product, which is a further series of Maillard reactions. The Maillard reaction is the reaction between hydroxyl groups of reducing sugars and amino groups of proteins, peptides, or amino acids to produce brown polymers (melanoidin) (Winarno, 1997).

In acetylation modification, the starch color change becomes duller white due to NaOH added to the starch suspension. According to Xie*, et al* (2005), during the acetylation process there is two side reactions namely deacetylation process and sodium acetate formers from the reaction of NaOH and acetic acid used. Sodium acetate is a brown color that can affect the color of modified starch suspension. Sodium acetate can be separated from the starch suspension by washing and centrifugation. However, if there is sodium acetate remaining in starch it can affect the degree of white starch modification (Ulfah, 2011).

Amilography Characteristic

a. Initial Temperature of Gelatinization

The initial temperature of gelatinization is the temperature at which the bond begins to weaken and the swelling of starch granules (Hapsari et al., 2011). The initial temperature of HMT, SPT, and HT modified ranged between 81.94 - 83.76 °C, 80.86-82.29 °C, and 81.50 - 82.28 °C, while taro native starch at 81.76 °C. The initial temperature of AST modified starch was 78.66 °C. These results indicate that only the AST has an effect of decreasing the initial temperature of gelatinization, as other modifications tend to increase the initial temperature of gelatinization.

Starch gave the HMT, SPT, and HT changes the structure of the bonding and granular shape. The rearrangement of short amylopectin chains facilitated by heat energy and the presence of water during the pressurized steam process leads to an increase in the initial temperature of gelatinization. The largest amylose molecule in the amorphous region binds to the amylopectin branch chain of the crystalline region so that this interaction reduces the mobility of the amylopectin chain or increases the stability of molecular interactions in the starch, causing the starch granules to be stronger and denser (Maache-Rezzorg et al., 2009),

The process of acetylation modification causes the temperature of starch gelatinization to decrease due to the substitution of acetyl groups (-COCH3) in starch molecules. The insertion of acetyl groups in starch molecules is mainly on the amorphous part (Chen *et al*, 2004). The compactness of

the molecular chain decreases because the incoming acetyl group inhibits the formation of hydroxyl bonds. This leads to a decrease in the compactness of the amorphous portion of starch. Therefore, the swelling of acetylation modification starch is easier to occur than the natural starch.

b. Peak Viscosity

The peak viscosity indicates the point at which the starch granules reach maximum development on the heating process so that it will subsequently break. This parameter can be used as an indicator of ease of cooking and shows the strength of dough formed from gelatinization during processing in food applications (Marta, 2011).

The native taro starch has a peak viscosity of 4036 cP, while the peak viscosity of the HMT and SPT modified starch respectively increases. The longer the HMT and SPT, the peak viscosity decreases. The decrease in the viscosity of the starch peak after steam pressurization process is influenced by swelling volume, decreased granule swelling during the heating process, and amylopectin degradation during pressurization steam.

The decrease in peak viscosity indicates a decrease in the ability to inflate and loose polymer during heating (amylose leaching) (Marta, 2011). Beta and Corke (2001) reported that peak viscosity indicates a water-binding capacity and has a positive correlation with the final product quality of volume development and loose polymer.

Meanwhile, the modification of HT and AST give the effect of increased peak viscosity. Peak viscosity has increased compared to the value of native starch peak viscosity. An increase in the viscosity value of the modified starch peak compared with unrefined native starch can be due to increased rigidity will increase the viscosity of the starch paste, the rigid starch granules have better resistance to stirring.

The peak viscosity increased in acetylation modification caused by the insertion of the acetyl group in the starch molecule which weakens the binding power in the amorphous region of the starch granules. The insertion of the acetyl group affects the interaction between the molecular chains of starch, by intermolecular or intramolecular binding of the hydrogen so that the structure of the starch granules weakens thus causing an increase in the granule's absorption capacity to water (Betancur et al, 1997 cited by Ulfah, 2011).

c. Hold Viscosity and *Breakdown*

Hold viscosity is an index of ease of cooking and reflects the weakness of the granules in the expansion. The breakdown is the difference between the peak viscosity and the viscosity of the hot paste reflecting the stability of flour or starch during heating. The smaller the breakdown viscosity the more stable the starch paste or the flour paste to the heating (Oktaviani, 2013).

The breakdown viscosity of native taro starch is 2385cP. Based on the research results, the breakdown viscosity of the HMT, SPT, and HT modified starch decreased compared to the breakdown viscosity of the native starch. This indicates that the starch is more stable at warming temperatures. Meanwhile, the breakdown viscosity of AST modified starch is greater than the native starch. This indicates that AST modified starch exhibits lower heat stability than native starch.

According to Khomsatin (2011), the higher decrease of breakdown viscosity in the flour without heating treatment caused by the starch granules swelled max and began to break then the amylose molecules out of the starch granules. If the heating is maintained, more and more starch granules are broken and amylose molecules coming out of the starch granules are also more numerous. This causes the viscosity of the paste to become more dilute. While in pregelatinized corn flour with pressurized steam an increase in stability of starch granules due to increased inter bonds and intra-molecular amylose in the granules so that the ability of the granular swelling is limited and the granules are more able to withstand heat.

d. Final Viscosity and *Setback*

Final Viscosity and *Setback* indicates the ability of starch to rapidly retrograde. The higher the viscosity value of cold paste, the tendency of starch to form gel very easy (Wulandari, 2010). The

adjustment or change in viscosity during cooling is obtained from the difference between the viscosity of the cold paste and the viscosity of the hot paste. The higher the setback value indicates the higher the tendency to form a gel (increase viscosity) during cooling. The high setback value indicates a high tendency for retrograde. (Marta, 2011).

The viscosity of the cold paste and the setback viscosity of the native taro starch were 2694cP and 1043 cP respectively. After modification, the viscosity of the cold paste and the viscosity of the setback increased in HMT, SPT and HT modification while AST modification there was decreased. These results indicate that HMT, SPT, and HT modified taro starch have retrograde versus native starch, while AST modified starch not to be susceptible to retrogradation.

The viscosity of the cold paste and the decreasing viscosity of the setback along with the increase in the duration of HMT and pressure steaming and the increase in heat treatment temperature are associated with granular damage during the modification process and the presence of the amylose-lipid complexes formed after the modification process (Pukkahuta *et al*., 2008).

The mainly starchy amylose molecules recombined during cooling will result in the formation of gel structures and the viscosity of the cold paste and the increased setback. The increased viscosity during cooling shows the tendency of rejoining the starch and illustrates the tendency of the product to be retrograde (Hagenimana *et al.,* 2006 cited by Marta, 2011).

Retrogradation is the formation of microcrystalline tissue from amylose molecules that bind to one another or by branching amylopectin outside the granules after the paste is cooled (Winarno, 1997). According to Beta and Corke (2001), the setback can

CONCLUSION

1. Talas Banten has the high nutrition content especially starch and micronutrient which potential to be used for substitution of rice as a staple food in Indonesia.
2. Heat moisture treatment, steam pressure treatment, heat treatment, and acetylation starch modification change the functional properties and amilography of taro starch (Xanthosoma undipes K. Koch).
3. Heat moisture treatment, steam pressure treatment, and heat treatment experienced an increase in gelatinization initial temperature, lower breakdown viscosity value so as to be more stable against heating, and higher setback viscosity showed a tendency to be more easily retrograde.
4. Acetylation modification decreased the initial temperature of gelatinization, increased viscosity of breakdown or less stable heating, and lower setback and freeze-thaw stability viscosity values compared to all modifications. Acetylation modification starch has the best stability at low temperature**.**
5. Talas Banten has the potentiality to be developed to ensure food security as well food industry based on the appropriate needed

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FARMER'S PERCEPTION OF THE RICE TRANSPLANTER AND COMBINE HARVESTER, CASE STUDIES IN BANTEN, INDONESIA

[1,2*)] Eka Rastiyanto Amrullah, [2)] Yati Astuti, [1)] Akira Ishida

[1)] Graduate School of Agricultural Science, Kobe University, Kobe, Japan
[2)] Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture, Indonesia

*) Correspondence e-mail: 162a141a@stu.kobe-u.ac.jp

Abstract

This study aims to determine the perception of farmers against rice ransplanter and Combine Harvester which is a grant from the government in order to increase rice production in Indonesia and identify the factors that affect the perception of farmers. Farmers who have low perceptions of both machines argue that both innovations are not compatible with the environment, not in accordance with socio-culture, if the plant uses transplanter, the farmer must change the habit. While those with high perceptions assume that using both machines can reduce the costs of wages and crops, can accelerate the process of planting and harvesting and obtain better results than the manual way. Socio-economic factors related to perception are Farming Experience, Farm size, Extension access. Extension activities are very important and needed by farmers, because the extension activities can accelerate the process of adoption of a new technological innovation. The results of interviews with farmers, such as technical training Rice transplanter and Combine Harvester operation, because they consider the training activities are still lacking, although there are only a few farmers

Keywords : Perception, Rice Transplanter, Combine Harvester

INTRODUCTION

Mechanization is one factor that has a significant influence on increasing agricultural production. The use of agricultural mechanization is intended to handle work that is not possible manually, efficiency in the use of input production, improve quality and productivity and provide added value of agricultural products (Handaka, 2002). Mechanization of agriculture leads to increased inputs because it can create higher cropping intensities and larger areas and increased productivity of agricultural labor; Can increase agricultural production and profitability due to timeliness of operations, better quality of work and efficient utilization of inputs (Amare, 2016). The correlation between the mechanization index and the technical efficiency shows the mechanization impact on the technical efficiency of rice production caused by the use of appropriate methods (Hormozia, 2012)

There are several benefits and opportunities of negative impacts that can be caused by its application in the farming process, then in its application need to be considered socio-economic-cultural conditions (Graham, 1997) farmland area; Type of farm commodity; Availability of skilled labor in operation; And support facilities and infrastructure specifically for development, including human resources and institutional facilitators during the transfer process and implementation of technology (Handaka, 2014). Not all technologies can be adopted and applied simply because the characteristics and conditions of agricultural land in each region vary. The technology should be studied, modified, developed, and then applied to local farming systems. In developing countries, the role of government as policy maker is very important, both in the innovation of tools and agricultural machinery that meet the needs of farmers and in community empowerment. The role of the government is also needed to assess farmers' perceptions of technological innovation, and make adjustments in agricultural policy making. Zeng (2011) states that the level of perception has an influence on the behavior of the use of technology.

To increase rice production, in 2014, the Indonesian government provides grants of Rice transplanter and Combine harvester to farmers belonging to farmer groups. In some places, especially in Banten province, the machine is new innovation for farmers. Innovation is everything ideas, ways or the object perceived by an as something new. Understanding farmers for technological innovation necessarily requires mental readiness to take decisions for the adoption of useful technologies and applied through the process of perception (Edwina, 2010). According to Morgan (1966), perception is a process that starts from the vision to form a response that occurs within the individual, so that the individual is aware of everything in the environment through the senses he has. Process-related perceptions to interpret a sensation so that it becomes meaningful. Perception is more focused on the meaning of experience formed along the processes in learning and thinking. The perception formed within the farmer will influence his perspective on the advantages and disadvantages of technological innovation. Such perceptions can be one of the driving or inhibiting factors for farmers in the use of technological innovation (Theresia2016). Hadiwijaya (2011) argued that perception is a process of knowing and recognizing objects and events that are objective with the help of sensory devices. Perception is a direct perception of something, therefore perception can be interpreted as the initial stage of decision of farmers in choosing and developing the farm (Anggreany, 2013). Hamid (2013) suggests that the positive perception of the community illustrates that the community can adopted agricultural innovation in life, so that a positive impact on economic aspects and social aspects of the community.

From the explanation it is necessary to know the perception of farmers to both innovations, because perception is one factor that affect the behavior of farmers. Perceptions of farmers on agricultural machinery is closely related to the willingness of farmers to use the machine (Romadi, 2016). Perceptions are influenced by experience and knowledge owned by farmers. The formation of perceptions is influenced by internal factors and external factors from farmers. Internal factors that influence, among others, age, and gender. External factors that can affect are family characteristics that include the number of family members, work, and family income (Ardiansyah, 2012). The personal characteristics of farmers have a positive and significant relationship with perception. Age, education and farming experience of farmers have a positive and significant relationship with their perceptions (Adeola, 2015, Kolawolel, 2012 and Kong, 2015). Amrullah (2015) states that access to extension have affects to farmers' perceptions. This research will study about farmer perception toward Rice transplanter and Combine harvester in order to identify the perception of farmers and farmer characteristics determine the relationship with the farmer's perception of the Rice transplanter and combine harvester in Banten Province, Indonesia.

RESEARCH METHOD

The study area was Banten Province, Indonesia covering three districts of Pandeglang, Lebak and Serang. The geographical of Banten Province on the Astronomical boundary is 105º1'11² - 106º7'12² BT and 5º7'50² - 7º1'1² LS. Location in the West End of Java Island positioned Banten as the gateway of Java and Sumatra and directly adjacent to the area of DKI Jakarta as the capital of the State. This position certainly caused Banten as the main liaison of Sumatra-Java trade route even as part of Asian and International trade circulation. The northern boundary borders the Java Sea, the West with the Sunda Strait, and in the South is bordered by the Indian Ocean.

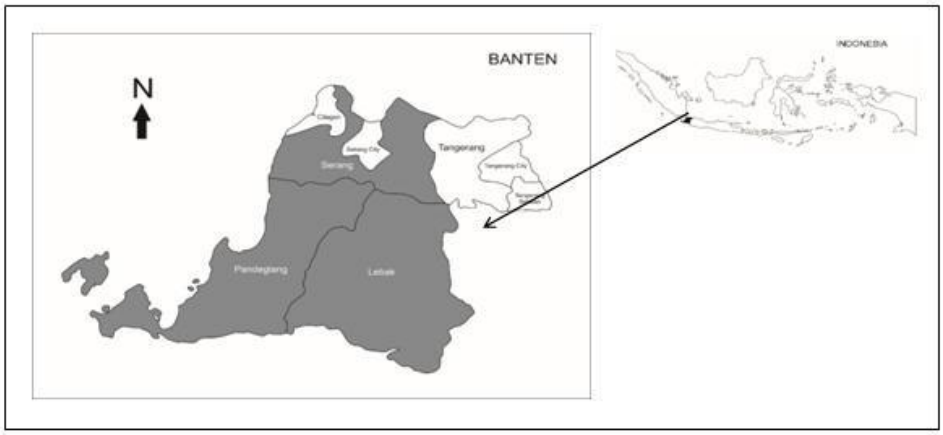

Figure 1: Map of study area

Problems encountered in food self-sufficiency, especially rice, among others, rice productivity that tends to stagnate and even decline. The problems include irrigation, seed, fertilizer and agricultural machinery. Agricultural machinery and machinery, needed to overcome the reduced rice planting services that resulted in longer rice cultivation period, so that efforts simultaneous planting recommendations in a stretch / area does not be implemented optimally. In addition to the above aspects, rescue production with appropriate postharvest treatment is important to adopt. One of the solutions offered to overcome the above problems is the application of modern agriculture using agricultural mechanization technology, starting and soil activity, planting to harvest and threshing. To achieve food self-sufficiency, the government grants agricultural machinery equipment such as Rice Transplanter and Combine Harvester to farmers who are members of farmer groups (Saliem, 2015). In 2014, in Banten Province there are 12 rice transplanter and 10 combine harvester spread over 4 districts, While the distribution of rice transplanter and combine harvester is presented in table 1.

Table 1. distribution of rice transplanter and combine harvester in Banten Province

District/City	Rice Transplanter	Combine harvester
Pandeglang	3	2
Lebak	2	3
Serang	5	4
Tangerang	2	1
Tangerang City	0	0
Cilegon City	0	0
Serang City	0	0
Tangerang Selatan City	0	0
Total	12	10

Source: Agriculture and Livestock Service of Banten Province 2015

In this study, 116 members of farmer groups receiving Rice Transplanter grants and 119 farmer group members receiving the Combine Harvester grant from the government, a total of 235 farmers. Was randomly selected for interviews by using The semi-structured questionnaire that was launched From April to September, 2015. Measurement of research indicators was done by scoring method on each indicator. Meanwhile, the farmers' perceptions of Rice Transplanter and Combine Harvester were evaluated by 5 points of the Likert-scale, with 25 negative statements about perception of Rice Transplanter and Combine Harvester, this statement is given to respondents to assess their perceptions. Responses to each item recorded on the five points of the continuum strongly disagree,

disagree, Hesitate, agree and strongly agree with scores of 5, 4, 3, 2 and 1, respectively. The total score of individual perceptions is calculated by summing the number of sub items as perceived by individual farmers. Thus obtained a maximum score of 125 and a minimum score of 47. Afterwards, data were analyzed using the multiple linear regression analysis, was explored estimate the relation between the socio-economic characteristics of farmers and perceptions as illustrated in the following formula:

$$Y1 = \beta 0 + \beta 1x1i + \beta 2x2i + ... + \beta k\, xki + ei$$

Where *Yi* is the perception of Rice Transplanter and Combine harvester, β0 is the constant term; β1 to β*k* are the coefficients relating the *K* independent variables to the variables of interest; *xi* is the independent variables that belonged to socio–economic characteristics of farmers, and *ei* is the Standard error

RESULTS AND DISCUSSIONS.

Socio-economic characteristic of farmers

Socioeconomic characteristics of age, education, farming status and the number of household dependents affect farmers skills in managing farming (Asih, 2009). As for socioeconomic characteristic of the 235 respondents, Tabel 2. Shows, that 60.35% of Rice Transplanter respondents and 53,78% of Combine Harvester respondents are between 40 and 49 years old, 38.79% and 43.70% are finished elementary school, 41.38% and 43.70% have an farming experience between 10 and 19 years, 84.48% and 87.39% household size number between 1 and 5 persons, 67.24% and 62.18% own less than 0.5 ha farm size, 50% of Rice Transplanter respondents have rice productivity between 5001 and 6000 kg/ha and 54,62% of Combine Harvester respondents have rice productivity more than 6000 kg/ha, 85.34% and 86.55% gaining access of extension

Identifying Farmers' perception of Rice Transplanter and Combine Harvester

According to Rogers (2003), the adoption rate of an innovation depends on the adopter's perception of the technological innovation characteristics. Attributes that support the explanation of the adoption rate of an innovation include: (1) Relative advantage, (2) Compatibility (3) Complexity (4) Trial-ability, and (5) Observable. Farmers perception of Rice Transplanter and Combine Harvester shown in Tabel 3.

The relative advantage of an innovation is seen from a novelty that is better than ever, and makes it possible for farmers to achieve their goals better or at a lower cost than has been previously measured by economic benefits, technical benefits, and satisfaction. Tabel 3 shows 85.34% farmers suppose that relative advantage use of Rice Transplanter is at a medium level, The results of the interviews explained that farmers consider the economic benefits of using Rice Transplanter compared to manually planting are same. Meanwhile, 49.58% farmers consider that the relative advantage of using a Combine Harvester is high, Farmers argue, that harvesting using Combine Harvester is more beneficial because it can save cost, time and energy during harvest. The use of combine harvester machine is considered as a form of efficiency that the harvest can be faster and save labor costs of harvest (Amirullah, 2016, Praweenwongwuthi, 2009 and Tahir, 2003). According to Ivanovic (2014) Farmers' profits depend heavily on harvesting methods, because manual harvesting by hand and mechanical harvesting results in different costs, but also different revenues. Economic analysis related to technology is justified to switch from manual harvesting to mechanical harvesting in an area of more than 2.5 ha or 4 ha.

Tabel 2. Socioeconomic characteristic of farmers

Variable	Rice Transplanter				Combine Harvester			
	Frequency	Percentage (%)	Mean	S.E	Frequency	Percentage (%)	Mean	S.E
Age (years)								
30-39	7	6.03			6	5.05		
40-49	70	60.35			64	53.78		
50-59	34	29.31			41	34.45		
More than 60	5	4.31			8	6.72		
Total	116	100	48.04	0.531	119	100	49.07	0.611
Educational Level (years)								
Elementary School	45	38.79			52	43.70		
Junior High School	40	34.48			46	38.65		
Senior High School	31	26.73			21	17.65		
Total	116	100	8.63	0.223	119	100	8.22	0.203
Farming Experience (years)								
1-9	18	15.52			15	12.60		
10-19	48	41.38			52	43.70		
20-29	35	30.17			32	26.89		
More than 30	15	12.93			20	16.81		
Total	116	100	17.27	0.801	119	100	17.89	0.833
Household size number (Number of persons)								
1-5	98	84.48			104	87.39		
6-10	18	15.52			15	12.61		
Total	116	100	4.36	0.102	119	100	4.38	0.101
Farm size (Ha)								
Less than 0.5	78	67.24			74	62.18		
0.5-0.9	22	18.97			20	16.81		
1-1.9	10	8.62			14	11.75		
More than 2	6	5.17			11	9.24		
Total	116	100	0.44	0.041	119	100	0.54	0.058
Productivity (kg/ha)								
Less than 4,000	1	0.86			1	0.84		
4,000-5,000	16	13.79			5	4.20		
5,001-6,000	58	50.00			48	40.34		
More than 6,000	41	35.34			65	54.62		
Total	116	100	5536.7	59.67	119	100	5884.4	52.43
Extension access								
Access	99	85.34			103	86.55		
No access	17	14.66			16	13.45		
Total	116	100	0.85	0.032	119	100	0 .86	0.031

Source: Self survey 2015

The compatibility of an innovation is concerned with the extent to which an innovation is considered consistent and conforms to the socio-cultural values and beliefs, or ideas introduced prior to the needs of farmers. Results show that 39.66% farmers Rice Transplanter and 30.25% farmers Combine Harvester assume that both of innovation not compatible with the environment, not in accordance with socio-culture, if the plant uses transplanter, the farmer must change the habit. Farmer's habit in planting and harvesting system is done by group which members to 8-10 labors. The group is alternated from one owner to the owner of other fields (Raharjo, 2012). The realization of cultivation and rice harvesting system begins with farmers requesting near neighbors to plant rice in

each predetermined part after rice ready for harvest, neighbors are told to re-harvest and share the rice crops with the farmers owners weighed with the pattern of comparison of crops Has been pre-selected. According to the results of interviews with farmers the meaning of this system for the village community is the meaning of sharing, mutual cooperation and togetherness. Farmers have a sense of solidarity with cultivators, they assume that using Rice transplanter and Combine harvester will reduce the income of labors. Medrano (2016) mention that the use of Combine Harvester could reduce farmers' income tenants, because their income comes from labor crops, and another effect is also can increase the migration of population from rural to urban.

Tabel.3. Farmers perception of Rice Transplanter dan combine harvester

Variable	Category	Rice Transplanter		Combine Harvester	
		Frequency	Percentage (%)	Frequency	Percentage (%)
Relative advantage	Low	3	2.59	10	8.40
	Medium	99	85.34	50	42.02
	High	14	12.07	59	49.58
	Total	116	100	119	100
Compatibility	Low	46	39.66	36	30.25
	Medium	57	49.14	41	34.45
	High	13	11.21	42	35.30
	Total	116	100	119	100
Complexity	Low	42	36.21	42	35.30
	Medium	67	57.76	63	52.94
	High	7	6.03	14	11.76
	Total	116	100	119	100
Trial-ability	Low	35	30.17	18	15.13
	Medium	76	65.52	82	68.90
	High	5	4.31	19	15.97
	Total	116	100	119	100
Observable	Low	19	16.38	13	10.93
	Medium	88	75.86	73	61.34
	High	9	7.76	33	27.73
	Total	116	100	119	100

Source: Self survey 2015

The complexity of an innovation is the degree to which an innovation is considered complex to be understood and applied. The more complicated an innovation, it will be difficult for the farmer to accept the innovation, on the contrary if the innovation is easy to apply, the easier it is for the technology to be practiced so that the adoption process of innovation gets faster. Innovation often fails because it is not applied correctly. Some of them require special knowledge or skill, sometimes it is more important to introduce a set of relatively simple but interlinked innovation packages, although they are difficult to understand (Edwina, 2010). Based on the table, 36.21% of farmers Rice Transplanters and 35.30% Combine harvester farmers consider that machine operation is both more difficult than manual, the use of both machines will be difficult to implement due to unavailability of skilled workers and limited equipment and spare parts. The results of interviews, training for farmers operators and the availability of spare parts of both machines is still very limited, according to farmers if there is damage to the machine, then they have to leave the area to get spare parts

The trial-ability of innovation to be attempted by farmers in relation to the limited resources available. Innovations that can be tried bit by bit will be faster used by farmers than innovations that can't be tried. Because the easier a new technology to be practiced, the faster the process of adoption

of innovations made by farmers. Thus, the complexity of an innovation has a major impact on the acceleration of adoption of innovation. Farmers tend to adopt innovations if they have been tried on a small scale in their own land and prove to be better than adopting innovation on a large scale, because innovation involves many risks. The ease to try has to do with the ease of sorting out to suit the needs of the farmer. Based on the study, 30.17% of respondents Rice transplanters consider a great risk if using the machine, and the limitations of trying the machine because it is only available one unit of Rice Transplanter for 1 farmer group of the number of members very much. Another case with the respondent Combine harvester, 68.90% of respondents argue that Combine Harvester is enough to be tried by farmers and only 15.13% assumes un-tried.

Innovation should be observable by farmers and seen by others. In a certain period of time, innovations affecting farmers' income will gain attention even without the aid of extension. An innovation can be observed from several things: production is produced by using technology, quality generated by technology; And the cost reduction used through the application of technology. Based on the data, 75.86% of respondents Rice Transplanter and 61.34% of respondents Combine Harveter considers that the machine is quite easy to observe the results, while 27.73% of respondents Combine Harvester considers that the impact of the use
this machine quickly visible. Interview result, farmer mention that result of combine harvester usage got clean grain. This is in accordance with the results of the study of Sulardjo (2014) which states using Harvester Combine machine which is a cutting tool and collector combined with the tool thresher, separating the grain from the stalks and feces, so that by using this tool will be obtained clean rice grain

The relationship between socio-economic characteristics with farmers' perceptions

The results of the relationship between farmers' perceptions and socio-economic characteristics are shown in Table 4. Based on these results can be seen that the higher the experience obtained respondents will be better perception of both machine tools. Farmers who have higher experience in farming will have a good perception due to the farmland owned by farmers is significantly correlated with the perception level of Rice Transplanter and Combine Harvester. This illustrates that the wider farmland owned by farmers the better the perception of the two machines. This is in accordance with the characteristics of both machines used to accelerate the cultivation and harvesting process with relatively wide land conditions. Smallholder farmers have a perception that they do not need both machines in their farms, because they will be difficult to operate on small farms

Table 4. Results of regression analysis of farmer's perception of Rice Transplanter and Combine Harvester relation to characteristic of farmers

Variable	Farmers perception of Rice Transplanter			Farmer perception of Combine Harvester		
	Coefficient	S.E.	P>t	Coefficient	S.E.	P>t
Age	0.018	0.206	0.930	0.261	0.202	0.200
Education level	0.527	0.376	0.164	-0.096	0.431	0.824
Farming Experience	0.237	0.115	0.042	0.316	0.141	0.028
Household size number	-0.028	0.890	0.975	-1.684	0.933	0.074
Farm size	13.464	1.773	0.000	7.975	1.385	0.000
Productivity	-0.002	0.001	0.077	0.000	0.001	0.775
Extension access	9.947	2.246	0.000	11.052	2.576	0.000
Constant	61.322	12.669	0.000	51.406	12.328	0.000
Adjusted R-squared	0.4832			0.4339		

Access to counseling is closely linked to farmer perceptions of Rice Transplanter and Combine Harvester. Farmers who have access to counseling have a good perception of both machines. This is because that in the extension process, farmers are given knowledge and understanding of the benefits

of both machines. The results of interviews with farmers, that those who follow the extension activities are given materials introduction and procedure of use by extension officers, so they know the advantages and benefits of the two machine tools.

CONCLUSIONS

Not all farmers have a good perception of Rice Transplanter and Combine Harvester. Farmers who have bad perceptions assume that the two machine tools are not in accordance with local socio-culture, so to use it, farmers must change the habits that have been done so far. Farmers who have a good perception of both machines assume that using these tools and machinery can reduce labor costs, speed up planting and harvesting times, and get better yields compared to harvesting manually.

From the analysis results obtained that socio-economic factors that affect the level of farmers perception of Rice Transplanter and Combine Harvester is the experience of farming, farm size and extension access. Based on these results, then in developing the knowledge of farmers on Rice Tranplanter and Combine Harvester to note the three factors. Extension activities are very important and needed by farmers, because with the extension activities can accelerate the process of adoption of a new technological innovation. The results of interviews with farmers, they hope to get more extension activities, such as technical training Rice Transplanter and Combine Harvester operation, because they consider the training activities are still lacking, although there are only a few farmers.

In policy making grant of tools and agricultural machinery should pay attention to the needs of farmers is very urgent. The results of interviews with farmers, although they receive any assistance from the government such as Rice Transplanter and Combine Harvester, but many more need hand tractors to cultivate agricultural land, because according to them, the availability of hand tractors in the area is very poor, so sometimes to process their land must wait alternately with other farmers, sometimes even bringing hand tractors from other areas

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STUDY OF VARIETY AND FERTILIZATION OF CORN YIELD IN THE DISTRICT TANGERANG, BANTEN

[1*)] Resmayeti Purba, [1)] Muchamad Yusron and [1)] Dewi Haryani

[1)] Banten Assessment Institute for Agricultural Technology

[*)] Correspondence e-mail : resmayeti63@yahoo.com

Abstract

Corn yields could be improved with using high yield variety and proper fertilization, both dose and type of fertilizer. This study aimed to determine the effect of varieties and fertilizer on corn. The experiment was conducted using factorial design with two factors, where the first factor was the three varieties of corn (V1:Sukmaraga, V2: Srikandi Putih, V3:Gumarang) and three doses of fertilizer (F1:Urea 350 kg + SP-36 100 kg + KCl 50 kg + organic fertilizer 2 tons per hectare; F2: Urea 225 kg + NPK Phonska 300 kg + organic fertilizer 2 tons per hectare and F3: Urea 100 kg + NPK Phonska 200 kg per hectare). The results showed that Sukmaraga had higher yield than two other varieties:, while dose of fertilizer of Urea 350 kg + SP-36 100 kg + KCl 50 kg + organic fertilizer 2 tons per hectare gave higher yield. Sukmaraga variety resulted highest average corn yield which is 5.5 t/ha, followed by Gumarang (4.8 t/ha) and Srikandi Putih (3.3 t/ha).

Keywords : corn, yield, variety, fertilization

INTRODUCTION

Corn is one of the prioritize commodity to be developed in the Ministry of Agriculture. Domestic corn production is expected to meet the needs of feed and food which tends to to increase yearly. The feed industrial need of raw materials increased by 10-15%, while the corn production in Banten Province is still low. In 2014 corn harvested area in Province of Banten is about 3.152 ha with its productivity of 33.36 quintals/ha and production of 10,514 tons (BPS Banten, 2015).

Corn productivitc can be increase by using high yield variety and proper dosage of fertilizers. Many researches have proven that crop variety and fertilizers significantly increased corn productivity. Fadwiwati and Tahir (2013) stated that variety and fertilization are factors that affect corn productivity. According to Taufik and Thamrin (2009), by using high yield variety corn production increased 15%, while combination of variety and fertilizers may increase corn yield up to 30%. The low productivity of corn at farm level due to many factors, such as frequent climatic disturbances, pests and diseases, the use of poor seed quality, and unbalanced fertilization (Susanto and Sirappa, 2015). This situation also found in Pandeglang.

Long experimental works in Cereal Crops Research Institute (Balitsereal) has resulted some high yield varieties of corn. Some composite corn varieties are Gumarang, Sukmaraga, Bisma, Srikandi Putih, Srikandi Kuning, Lamuru with average yield potential of 5-10 t/ha (Adnan *et a*l., 2012). Those varieties have been tested in many areas, such as in Lampung, which was shown that Sukmaraga and Srikandi Kuning are two varieties that more adaptive to local ecosystem (Rumbaina and Mustikawati, 2007).

The use of balanced fertilizer is one component of integrated crop management. Fertilization affect the growth and yield of corn, however, intensive use of high dosage of chemical fertilizers, especially fertilizers N, P and K may cause declining land productivity. Therefore, application of organic matter is very important in order to improve soil organic C content, as well as to provide soil nutrients. N and manure significantly increased the growth and weight of corn kernels (Kasno and Rostam, 2013). Optimal dosage of fertilizer of composite corn has been recommended by Balitsereal.

Unproper dosage and application of fertilizer resulting in low efficiency use of fertilization (Efendi *et al.,* 2012) and to obtain optimum corn yields need application-specific fertilization recommendations (Fadwiwati and Tahir, 2013).

The experiment was conducted to examine the effect of the use of high yield variety and fertilizers dosage on corn growth and its yield in Tangerang District, Banten

RESEARCH METHODS

This experiment was done in paddy fields in the village Cisauk, district Tangerang from May to July 2016. The experiment was conducted using complete factorial block design with three replications. The first factor was variety of corn and the second factor was fertilizer dosage. Varieties used in this experiment are Sukmaraga (V1) Srikandi Putih (V2) and Gumarang, (V3) while 3 doses of fertilizer are (F1) recommended fertilizers dosage (350 kg Urea + 100 kg SP-36 + 50 kg KCl + 2 tons of manure per hectare, (F2) fertilizer dosage recommended by KATAM, ie 300 kg Urea + 250 kg NPK Phonska + manure 2 tons per hectare, (F3i) existing fertilizer farmers dosage, ie 100 kg Urea + 200 kg NPK Phonska per hectare. Plot size was 300 m2. Channels between treatments were made to avoid contamination between plots fertilizer treatments.

Manure was applied during land preparation and soil cultivation. The seed was planted in 5 cm deep, 1-2 seed per planting hole, and planting space was 70 x 25 cm. Seed treatment was applied to control downy mildew (Muis *et al*., 2013). 1 kg of seeds are mixed with 2 g Ridomil dissolved in 7.5 to 10 ml of water.. The first weeding is done at 15 days after planting and the second at the age of 20-30 days.

Parameters measured were: plant height and yield. Plant height was measured a day before harvested, 10 sample plants each treatment plot. Corn yield was measured using sample area 3 m x 2.75 cm (4 lines x 11 plants), where sample are were taken in the mid of plot randomly. Data were tabulated and statistic analysis was done using SAS program by Duncan test to determine differences between treatments.

RESULTS AND DISCUSSIONS

Effect of Variety and Fertilizers on Plant Height

Effect of varieties and fertilizer dosage on plant height was presented on Table 1. Plant height, which is measured a day before harvesting time, was found quite varied among varieties and fertilization of each plot. It seems that there was no effect of combined treatment of plant variety and fertilizer dosage on plant height. Corn variety and fertilizer dosage has solely significant effect on plant height. Table 1 shows that the highest plant (205 cm) was reached by Sukmaraga variety, which is significantly different to other varieties. Plant height of Srikandi Putih and Gumarang were respectively 185 cm and 193 cm. This condition is in line with potential plant height of the varieties (Aqil et al., 2012). The potential plant height of Sukmaraga, Srikandi Putih and Gumarang respectively are 180-220 cm, 195 cm and 160-210 cm.

Fertilizer dosage was also significantly affected plant height. Recommended dosage of Balitsereal, i.e. Urea 350 kg + SP-36 100 kg + KCl 50 kg + organic fertilizer 2 tonnes per hectare yielded highest plant height of corn of 206 cm, significantly different compared to other fertilizer treatment (Table 1).

Based on the results of statistical analysis there was an interaction between varieties and fertilization on plant height. Table 1 showed that the combined treatment of varieties Sukmaraga with fertilization Urea 350 kg/ha + SP-36 100 kg/ha + KCl 50 kg/ha + organic fertilizer 2 tons/ha gave high crop (220 cm), followed by combination treatment varieties Gumarang (201 cm) with fertilization Urea 350 kg/ha + SP-36 100 kg/ha + KCl 50 kg/ha + organic fertilizer 2 tons/ha and variety Srikandi White (198 cm) with fertilization Urea 350 kg/ha + SP-36 100 kg/ha + KCl 50 kg/ha of organic fertilizer + 2

tons/ha. While the combination treatment provided the lowest plant height was obtained on treatment combinations Srikandi Putih varieties with fertilizer Urea 100 kg/ha and NPK Phonska 200 kg/ha + without organic fertilizer (178 cm). Thus, the combination use of improved varieties and fertilizer Sukmaraga Urea 350 kg/ha + SP-36 100 kg/ha + KCl 50 kg/ha of organic fertilizer + 2 tons/ha a treatment combination that gave the highest crops.

Table 1. Effect of plant varieties and fertilizer dosage in plant height of cron at the harvesting time

Varieties	Fertilizer Dosage			Average
	F1	F2	F3	
Sukmaraga (V1)	220	200	196	205a
Srikandi Putih (V2)	198	180	178	185c
Gumarang (V3)	201	199	182	193b
Average	206a	193b	185c	

Note : The numbers in the columns and rows followed by the same letter do not differ at the level of 0.01 Duncan test

Effect of Variety and Fertilizers on Corn Yield

Table 2 shows that crop varieties and fertilizer dosage significantly affected corn yield. Sukmaraga variety resulted highest average corn yield which is 5.5 t/ha, followed by Gumarang (4.8 t/ha) and Srikandi Putih (3.3 t/ha). The corn yield in this experiment are lower than its potential yield, that are 6 t/ha, 5 t/ha and 5.8 t/ha, respectively for Sukmaraga, Gumarang and Srikandi Putih. The yield gap between potential and actual yield of Srikandi Putih variety is enormous, i.e. 2.5 t/ha. This result shows that Sukmaraga and Gumarang are more adaptable to Tangerang conditions, while Srikandi Putih variety is not adaptable.

Fertilizer dosage treatment was knowingly affected corn yield (Table 2). Recommended dosage by Bailtsereal i.e. Urea 350 kg + SP-36 100 kg + KCl 50 kg + manure 2 tons per hectare gave the highest corn yield (5.4 t/ha), followed by fertilizer dosage recommended by KATAM (Urea 225 kg + 300 kg NPK Phonska + manure 2 tons per hectare) and fertilizer farmer dosage (Urea 100 kg + NPK Phonska 200 kg per hectare). However corn yield of the treatment of fertilizer dosage recommended by Balitsereal (5.5 t/ha) is found statistically not significant to treatment of fertilizer dosage recommended by KATAM (4,7 t/ha)

Table 2. Effect of crop varieties and fertilizer dosage corn yield (t/ha)

Varieties	Fertilizer Dosage			Average
	F1	F2	F3	
Sukmaraga (V1)	6.7	5.8	4.0	5.5a
Srikandi Putih (V2)	3.5	3.3	3.0	3.3b
Gumarang (V3)	5.9	5.4	3.2	4.8ab
Average	5.4a	4.7ab	3.4c	

Note : The numbers in the columns and rows followed by the same letter do not differ at the level of 0.01 Duncan test

This study indicated that the use of high yield varieties and/or with fertilizer treatment was able to increase corn yield. By using high yield variety of Sukmaraga combined with improved fertilizer dosage (Urea 350 kg + SP-36 100 kg + KCl 50 kg + manure 2 tons per hectare) increased corn yield from 3-4 t/ha to 5.4 t/ha.

The result of this experiment shows that fertilizer dosage applied at the farmer level, 100 kg Urea and 200 kg NPK Phonska, without manure, is not sufficient to provide crop nutrient needs. According to Herniwati and Tandisau (2010) , 90 kg N, equal to 200 kg Urea, is the optimum and efficient fertilizer dosage to increase corn yield. N deficiency will cause the corn crop has a high vegetative growth but lower yields (Runcajaniningsih *et al*., 2013). Fadwiwati and Tahir (2013) states that nitrogen is a nutrient that greatly affects plant growth and yield of corn. As an essential nutrient,

nitrogen that serve as the building blocks of amino acids, proteins, and the building block components of the cell nucleus. Phosphorus deficiency affects the metabolism and growth especially cobs and seed formation while potassium deficiency can reduce corn yield by 10% (Runcajaniningsih *et al*., 2013).

For optimum corn yields, in addition to fertilizer N, P, K impartial need to add organic fertilizer/manure 2 t/ha, especially on soil organic matter content was low. The content of the low soil organic matter can lead to low soil fertility, low soil aggregate stability so that the productivity of the soil decreases. To overcome this, land rehabilitation efforts should be made that improve soil physical and chemical environment that is suitable for plant growth. One alternative to improve the condition of the soil environment is the provision of organic matter into the soil. Soil organic matter is a soil biological buffer to maintain a sustainable supply of nutrient for plants (Ruchjaniningsih *et al*., 2013). The supply of organic matter in maize farming land is required of organic matter so that shortages and damage to physical and chemical properties of the soil can be improved. Soil improvement by providing organic material from various sources have been reported to improve the physical and chemical properties of soil. Organic materials have multifunctional, such as improving soil aggregates, increasing the water-holding capacity, improve soil porisitas and affect permeability and infiltration. Maintaining organic matter content of soil through manure application is expected to increase the yield of corn. Manure as organic material can increase the exchange capacity of the soil (CEC) so the ground to avoid poisoning (Zubactirodin and Subandi, 2008) Fertile soil physical properties and clams optimum for plant growth because organic material serves as a source of nutrients, to support the availability of nutrients and life microorganisms in the soil. The addition of organic fertilizer in addition to improving soil fertility can also provide a good atmosphere for the growth of roots, both weight and length of the roots of corn plants so that with a good root system, a chance for greater absorption of nutrients that have an impact on the growth of corn plants are optimal.

The combination treatment provided the highest corn yields were varieties Sukmaraga with Urea fertilizer 350 kg/ha + SP-36 100 kg/ha + KCl 50 kg/ha of organic fertilizer + 2 tons/ha (6.7 t/ha), followed by the Gumarang varieties combined treatment with urea fertilization 225 kg/ha + 300 kg/ha NPK + organic fertilizer Phonska 2 tons/ha (5.9 t/ha) and the lowest corn yields obtained on treatment combinations Srikandi Putih varieties with Urea fertilizer 150 kg/ha and Phonska NPK 200 kg/ha + without organic manure (3.4 t/ha). Assessment in Lampung using Sukmaraga varieties using 300 kg of urea fertilizer + 100 kg SP-36 + 150 kg KCl + 5 tons of manure obtained maize yields of 5.6 t/ha (Rumbaina and Mustikawati, 2007). Further assessment Sukmaraga varieties on dry land in the South Sulawesi 250 kg Urea fertilizers ZA + 100 + 100 + 100 SP-36 KCl obtained average maize yields of 4.6 t /ha (Taufik *et al*., 2015).

Variety has a significant role in increasing crop yields of corn. Likewise fertilization have an important role in increasing the yield of corn. Corn fertilizer by recommendation of Balitsereal is a balanced and optimal fertilization for corn crop needs. Application of this fertilizer plus organic fertilizer provides highly significant effect in improving the yield of corn. In this study, the use of fertilizers based composite fertilizer recommendation of Balisereal for maize Sukmaraga combined with average organic fertilizers provided the highest corn yields (5.5 t/ha compared recommendation of KATAM fertilization with manure (4.8 t/ha) and fertilization existing farmers without manure (3.3 t/ha) as shown in Table 2.

Commonly farmer only applied of about. The fertilizer dosage obtained at the lowest corn farmers eksisiting treatment without manure. Low corn yield at the farmers allegedly existing fertilizer treatment plant deficiencies of N, P and K. NPK fertilization and balanced enough to promote the growth and yield of corn is higher as on fertilization treatment by recommendation of Balisereal.

CONCLUSION

1. Sukmaraga variety is found more adaptable to Tangerang ecosystem than to varieties Srikandi Putih and Gumarang
2. Fertilizers dosage recommended by Balitsereal, i.e. Urea 350 kg + SP-36 100 kg + KCl 50 kg + manure 2 tons per hectare, is an optimum dosage to get the highest corn yield of 5.4 ton/ha.

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ANALYSIS OF RICE PRODUCTION REQUIREMENTS IN WEST JAVA REGION

[1*)] Kulsum, [1)] Akbar Gunawan,[1)] Evi Febianti

[1)] Industrial Engineering, University of Sultan Ageng Tirtayasa, Indonesia

[*)] Correspondence e-mail : kulsum.ti@gmail.com

Abstract

In Law no. 18/2012 on food, food security is defined as the condition of the fulfillment of Food for the state up to the individual, which is reflected in the availability of adequate food, both quantity and quality, safe, diverse, nutritious, equitable, and affordable and not contrary to the religion, beliefs and culture of the community, Live healthy, active, and productive in a sustainable manner. Rice is one of the food products that are still in the main consumption by the majority of the population in Indonesia. West java is one of the rice producing regions. However, with various factors, rice production levels are sometimes fluctuating. Therefore, an analysis is needed to find out what level of rice production needs. Forecasting activity is a business function that seeks to estimate demand and use of the product so that the products can be made in the right quantity. Using quantitative forecasting techniques it is known that forecasting of rice production in West Java Province in 2016 amounted to 11487923.4 tons.

Keywords : food security, West java, Rice, Forecasting

INTRODUCTION

In line with the Law mandate, Act no. 18/2012 on the Food, the National Medium-Term Development Plan 2015-2019 prioritizes the improvement of food sovereignty as one of the priority sub-agendas to realize the national development agenda of economic independence by mobilizing the strategic sectors of the domestic economy. In order to improve and strengthen food sovereignty, the general policy in the RPJMN 2015-2019 is directed at: (1) Strengthening food security towards food self-sufficiency by increasing staple food production, (2) Stabilization of food prices, (3) Improving the quality of food consumption and community nutrition, (4) Mitigation of disruption to food security, and (5) Improvement of prosperity of food business actors. (Food Security Agency of the Ministry of Agriculture, 2015).

Rice (Oryza Sativa sp.) Is a plant originating from Bangladesh. From the rice plant produced rice, Which is the staple food of most Indonesian people. Indonesia's rice production accounts for about 9% of the world's total production. Indonesia The country's third largest rice producer in the world, after China (30%) and India (21%).

Rice crops are the most important agricultural commodity in the life of Indonesians. In addition, the agricultural sector, especially rice commodities play an important role in the life of the Indonesian nation, which is also expected to become one of the main commodities contributing foreign exchange countries from the non-oil sector.

Production of rice and the need for rice is an absolute must always get the attention of the government. This is because to prevent the demand for rice is greater than the farmers' rice production. Because if this happens then the welfare of society will be hampered by lack of basic foodstuff. It can also cause problems in other areas of government, such as health, education, economics, and others.

In order to stabilize food security, in 2015-2019 the Ministry of Agriculture will focus on increasing the strategic staple production of rice, corn, soybeans, sugar (sugarcane) and buffalo-meat and other agricultural commodities. Stabilization of food security, should be based on independence

and food sovereignty supported by the availability integrated subsystem of availability, distribution and consumption of food.

The achievement of robust food security is a vehicle for strengthening economic and political stability, and guaranteed food availability at an affordable price. In addition, as a manifestation of the nation's commitment to participate in realizing the goal of global development (Millennium Development Goals / MDGs) in reducing poverty and hunger.

Therefore, the study of forecasting of paddy production results into a very interesting object to be discussed further, which is useful to help governments and stakeholders take policy and preventive action. The object of research focus on West Java Province as the area of rice granary. Indonesia also has a large enough population so it is expected that West Java is able to meet the availability of rice in its own region even contribute to other regions.

Through forecasting is expected to minimize the influence of uncertainty in the future. Forecasting that will be used is to use the method of double exponential smoothing.

RESEARCH METHOD

Theory of Forecasting

According to Gaspersz (2004), Forecasting activity is a business function that seeks to estimate demand and use of the product so that the products can be made in the right quantity. Forecasting is a conjecture of future demand based on some predictor variables, Often based on historical time series data.

Quantitative forecasting methods can be divided into two types, causal and time series. The causal forecasting method includes factors related to predicted variables such as regression analysis. Time series forecasting is a quantitative method for analyzing past data that has been collected regularly using appropriate techniques. The results can be used as a reference for forecasting the value in the future (Makridakis, 1999).

Double Exponentials Smoothing

Double Exponential Smoothing Method This method is a linear model proposed by Brown. In Double Exponential Smoothing method, smoothing process is done twice. There are two methods in Double Exponential Smoothing, that is :

a) One Linear Parameter Method from Brown's
   This method was developed by Brown's to address the differences that arise between actual data and forecasting values when there is a trend on the plot. The rationale of the linear exponential smoothing of Brown's is similar to the linear moving average, Because both single and double smoothing values are missing from the actual data whenever there is an element of trend. The difference between single and double smoothing values is added to smoothing values and adjusted for trends.
b) Method Two Parameters from Holt
   This method of trend value is not passed by double-smoothing directly, But the trend smoothing process is done with different parameters with the parameters on the original data smoothing.

Rice production data in West Java

Based on data obtained from the Central Bureau of Statistics of West Java, Obtained data of Rice production in West Java during the period 2006 to 2015. Previous period sales data is used as a guide to perform forecasting methods. The following is the data of rice production in West Java.

Tabel 1. Rice Production Data of West Java

YEAR	PRODUCTION (Ton)
2006	9418572
2007	9914019
2008	10111069
2009	11322681
2010	11737070
2011	11633891
2012	11271861
2013	12083162
2014	11644899
2015	11373144

Here is a picture and description of the General Flow Chart to examine the problem:

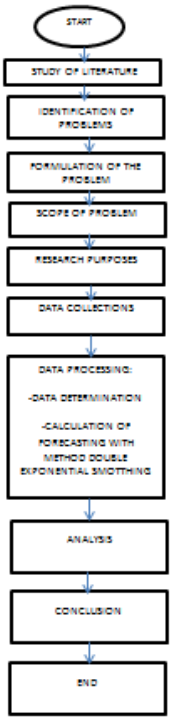

Figure 1: ***Flow Chart Research***

RESULTS AND DISCUSSION

In determining forecasting the first step is to determine the pattern of production data whose purpose is to facilitate and convince in analyzing the data so that it will produce more accurate forecasting (Ali etc, 2011).

Based on data of food production for rice sub-sector shows pattern of data tendency up and down. Therefore, a more accurate forecasting method used is the double exponential smoothing method. The following is the pattern of rice production data from 2006 to 2015. *Forecasting of Rice Production in 2016.*

By determining the forecasting method for the production of rice, then performed the calculation with microsoft excell program. The forecasting method used is Double Exponential Smoothing. Forecasting calculations are also tested based on alpha (á) values, among others, with values (0,1), (0,5) and (0,9). The three alpha values will be selected based on the value that gives the smallest error rate by looking at the value of MAE (Mean Absolute Error) and MSE (Mean Squared Error).

The forecasting result data with alpha value (á) = 0.1 (Table 2), with alpha (á) = 0.5 (Table 3) and with alpha (á) = 0.9 (Table 4). Based on the error rate obtained from the calculation, then it can be compared the error between alpha (á) (Table 5).

Table 2. Comparison of Alpha Error Values (á)

Double Exponential Smoothing	***Forecasting***	**MAE**	**MSE**
Alpha (á) = 0.1	11419786.97	907287	1137276007978.10
Alpha (á) = 0.5	11487923.4	555982.2	378644982750.93
Alpha (á) = 0.9	11101046.27	608177.4	491465571864.09

CONCLUSION

Based on the research that has been done can be obtained the following conclusion : The results of forecasting rice production in West Java in 2016 amounted to 11487923.4 tons.

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POTENCY OF SORGHUM PROCESSED PRODUCT TO CONTRIBUTE TO FOOD SECURITY AND NUTRITION

Tri Marwati

Assessment Institute for Agricultural Technology Yogyakarta, Indonesia

Correspondence e-mail : watipasca@yahoo.com

Abstract

Sorghum (*Sorghum bicolor* L. Moench) is one of the most important food staples in supporting food and nutritional security. Considering the fast pace of population growth, the effects of climate change on food production, meeting the global food demand will be a real challenge in the near future. This cereal is part of the diet of millions of people, representing for them a major source of energy and nutrients. Sorghum is a valuable grain, due to its content of protein and micronutrients, and it is an interesting option for coeliac and gluten intolerant people because of the absence of gluten. The nutritional value of sorghum can be improved through appropriate processing methods. Processing may modify sorghum chemical composition, functional and nutritional value. Processing can also ameliorate the food, by either inactivating, destroying or removing toxic components without any change in the nutritive value and acceptability of the food product.

Keywords : sorghum, food processing, food security, nutrition value

INTRODUCTION

Sorghum is one of the major traditional staple food crops in many developing countries; it represents an important subsistence crop for millions of people in the semi-arid tropics of Africa, Asia and Central America. Sorghum is widespread, nutritious, easy to grow and well adapted to hot and arid climates thus, it represents a good crop for exploitation (Proietti *et al*., 2015). The potential of sorghum in enhancing food security in some countries such as Zimbabwe (Mukarumbwa and Mushunje, 2008), Nigeria (Alla and Bello, 2010), Indonesi (Human, 2011), Central America (Rooney, 2011), Tanzania (Brown, 2013), Kenya (Mwadalu and Mwangi, 2013; Ogeto *et al.,* 2013), Afrina (Wambugu and Mburu, 2014), Indoa (Eddu, 2016), Cameroon (Vunyingah and Kaya, 2016) has been reported.

Considering the fast pace of population growth, the effects of climate change on food production, meeting the global food demand will be a real challenge in the near future. The relative importance of sorghum in food security suggests substantial opportunities should exist for their commercialization. As incomes rise and food preferences evolve, sorghum will be consumed in processed form. The commercial processing of sorghum is growing. However, this remains much more limited than would be expected (Rohrbach, 2004).

Post harvest sorghum management systems were very vital for food security. In order to promote sustainability of sorghum production among local producers, the interface between indigenous and modern production systems including technologies should be promoted and supported (Vunyingah and Kaya, 2016). Since processing and storage facilities, low income, access to credit, favorable government policy etc are important factors affecting food security, efforts should be made at providing farmers with all these needed inputs in order to improve food security level in the area. Farmers should also engage themselves in non-farm activities to enhance their income and food security status. Efforts should be made by research institutes to generate improved technologies on farming (Ala and Bello, 2010).

New advanced techniques applied for post-harvest technology and value addition are giving out more products of wide acceptance in rural as well as urban areas. In relation with the nutritional

quality, convenience of food uptake and other sensory properties, many food processing technologies have been developed. These techniques are widely used now-a-days and are milling, decortication, soaking, germination/malting and fermentation. These processes increase the nutritional value and are very effective in dealing with undernourishment problem and other food and health management practices. A large scale implementation of these technologies or commercialized use will increase the ease of adopting their products at wide scale. This type of commercialization will not only deal with the undernourishment problem but also will earn great profits for all the persons in chain from producer like farmers to the consumers but will require policy-support and campaign for health, ecological sustainability and nutritional benefits of the crop (Rothare *et al.,* 2016). So this review focuses on sorghum nutritional value, sorghum processing technology and product, and sorghum for security and nutrition.

NUTRITIONAL VALUE OF SORGHUM

The proximate composition and nutritional aspects of grain sorghum have been extensively reviewed by Tey found that grain sorghum protein varies from 4.4 to 21.1% with a mean value of 11.4%. Sorghum grain is known for its hardness compared to other food grains. Te hardness of the grain is due to higher content of protein prolamin. Prolamin content varies from 3.6 to 5.1%. Te Lysine content ranges from 1.06 to 3.64%. The protein fractionation studies in sorghum indicated that the distribution of albumin-globulin, prolamin and glutelin is about 15, 26 and 44% respectively of total nitrogen. Starch is the major constituent of grain accounting for 56-75% of the total dry matter in the grain. The total content of soluble sugars of sorghum grain ranged from 0.7 to 4.2% and the reducing sugars from 0.05 to 0.53%. Fat content in sorghum grain varies from 2.1 to 7.6%, crude fbre from 1.0 to 3.4% and ash from 1.3 to 3.3% (Hulse *et al.*, 1980; Subramanian and Jambunathan, 1980).

Another study on the physic chemical characterization of sorghum accessions showed a wide variation in protein (7.99 to 17.8%), lipids (2.52 to 4.76%), starch (51.88 to 85%), and amylose (12.30 to 28.38%) content. Linoleic acid (18:2) and oleic acid (18:1) were the major fatty acid constituents of sorghum lipids (Geleta *et al.,* 2005). The wide range in composition of mineral and trace elements indicated that sorghum is a good source of minerals. Te mineral composition however is influenced by the environmental conditions (Deosthale and Belavady, 1978).

A major issue for sorghum is the low digestibility (Rooney and Pflugfelder, 1986; MacLean *et al.,* 1986). The low digestibility of sorghum is presumably due to the proteins high cross linking and their location primarily on the periphery of the protein bodies (Duodu *et al.,* 2003; Afify *et al.,* 2012). Among sorghum proteins, kafirins (aqueous alcohol-soluble prolamins) are the major storage protein in the kernel, comprising about 70%–80% of whole grain flour protein (Hamaker *et al.,* 1995) Kafirins have poor nutritional quality, because of the scarce content of essential amino acids (especially lysine, but also tryptophan and threonine); in addition, they are the sorghum proteins with the slowest digestibility (Hamaker *et al.,* 1986) Sorghum proteins are deficient in the essential amino acid lysine as well as in the sulfur-containing amino acids (FAO, 1995; Hamaker *et al.,* 1986). In contrast, sorghum proteins contain a relatively high proportion of leucine, in particular compared to isoleucine, which determines an unfavorable leucine/isoleucine balance.

Sorghum proteins are deficient in the essential amino acid lysine as well as in the sulfur-containing amino acids (FAO, 1995; Hamaker *et al.,* 1986). In contrast, sorghum proteins contain a relatively high proportion of leucine, in particular compared to isoleucine, which determines an unfavorable leucine/isoleucine balance. An excess of leucine can interfere with the conversion of tryptophan to niacin (vitamin B3 or nicotinic acid), hence increasing the risk of niacin deficiency.

Most sorghum plants contain cyanogenic glycosides, although the quantity depends on several factors like the cultivar, the distribution in the plant tissues and the environment. The main cyanogenic glycoside, called dhurrin, is hydrolyzed by the β-glucosidase to produce p-hydroxybenzaylaldehyde and hydrocyanic acid or prussic acid, resulting in acute cyanide poisoning. The β-glucosidase may originate from the plant material or from certain gut microflora of exposed animals or humans (WHO,

1993). Anthocyanins in sorghum seeds are unique because they do not have a hydroxyl group on carbon ring (C) number 3 so called 3-deoxysiocyanin. The antocyanin in sorghum has been identified as apigeninidine and luteolininidine with levels of 36-50% in black sorghum (Awika *et al.,* 2004).The uniqueness causes anthocyanin in sorghum to be more stable at high pH than in fruits or vegetables that have potential for natural food coloring agents (Awika and Rooney 2004). Black sorghum had the highest anthocyanin content (average = 10.1 mg/g in bran). The brown and red sorghum brans had anthocyanin contents of 2.8−4.3 mg/g. Only 3-deoxyanthocyanidins were detected in sorghum. These compounds are more stable to pH-induced color change than the common anthocyanidins and their glycosides. Additionally, crude sorghum anthocyanin extracts were more stable than the pure 3-deoxyanthocyanidins. The antioxidant properties of the 3-deoxyanthocyanidins were similar to those of the anthocyanins. Pigmented sorghum bran has high levels of unique 3-deoxyanthocyanidins, which are stable to change in pH and have a good potential as natural food pigments (Awika *et al.,* 2004)

Table 1. Nutrient Composition of Sorghum Grain

Constituent	**Range**
Protein (%)	4.40 - 21.10
Water Soluble Protein (%)	0.30 – 0.90
Lysine (%)	1.06 – 3.64
Starch (%)	55.60 – 75.20
Amylose (%)	21.20 – 30.20
Soluble Sugars (%)	0.70 – 4.20
Reducing Sugars (%)	0.05 – 0.53
Crude Fibre (%)	1.00 – 3.40
Fat (%)	2.10 – 7.60
Ash (%)	1.30 – 3.30
Minerals (mg/100g):	
a. Calcium	11.00 – 586.00
b. Phosphorous	167.00 – 751.00
c. Iron	0.90 – 20.0
Vitamins (mg/100g):	
Thaimine	0.24 – 0.54
Naicin	2.90 – 6.40
Riboflavin	0.10 – 0.20
Anti-nutritional factors:	
Tannin (%)	0.1 – 7.22
Phytic acid (mg/100g) as Phytin Phosphate	875 - 2211.9

Source : Hulse *et al.,* (1980); Subramanian and Jambunathan (1984), Makokha *et al*, 2002

IMPROVING NUTRITIONAL VALUE THROUGH PROCESSING

The nutritional value of sorghum can be improved through appropriate processing methods. Processing may modify sorghum chemical composition, functional and nutritional value. Processing can also ameliorate the food, by either inactivating, destroying or removing toxic components without any change in the nutritive value and acceptability of the food product.

Sorghum tocochromanols, α-tocopherol, and vitamin E decreased after extrusion and increased after dry heat in a conventional oven. Carotenoids content in sorghum decreased after both extrusion and the dry heat in a conventional oven (De Cardoso *et al.,* 2015). Processing can also ameliorate the food, by either inactivating, destroying or removing toxic components or mycotoxin without any change in the nutritive value and acceptability of the food product (Waliyar *et al.,* 2007).

Two main processes are suggested to reduce the inhibitory effect of phytic acid on mineral absorption: the mechanical removal of PA by extraction or milling, or the enzymatic degradation of PA by activation of endogenous or addition of exogenous phytases (Hurrell *et al.,* 2004). A number of different processing technologies have been proposed in order to increase the digestibility of sorghum proteins. Among them, extrusion (MacLean, 1983; Hamaker, 1994) steam-flaking and reconstitution (Rooney et al., 1986) malting (Elmaki et al., 1999; Elkhalifa et al., 1999; Mahgoub et al., 1998; Abdelhaleem et al., 2008), fermentation (Abdelhaleem et al., 2008; Obizoba et al., 1991; Neelam et al., 2012) and popping (Duodu et al., 2001; Parker et al., 1999).

A study conducted by Proietti *et al.* (2013), on both characterized and traditional sorghum cultivars, reported that fermentation, alone and associated with cooking, significantly reduced mycotoxin content as well as increased phytase activity of sorghum grains, leading to enhancement of the estimated bioavailability of iron and zinc. On the other hand, cooking alone did not influence the concentrations of AN. The results also confirmed that trace mineral content was influenced neither by fermentation, nor by cooking, whereas it showed consistent linkage to variety.

Cooking process was also found to significantly increase soluble phenolic acids in sorghum and decrease the bound ones and anthocyanins (N'Dri *et al.,* 2013). Cooking of sorghum also resulted in increased TAC and enhanced total phenolic, flavonoid and flavonol content. Antioxidant components like phenolic compounds, flavonoid and flavanol of sorghum were clearly affected by in vitro digestion. In vitro digestion studies can be applied to analyze the dietary, processing factors on bioavailability of antioxidants. Measurement of in vitro physiological extracts of sorghum could be use to analyze the effect of sorghum antioxidants in different ailment conditions (Prajapati *et al*., 2013). Fermentation and cooking caused a more than 2-fold increase in soluble phenolic compounds, condensed tannins, and individual phenolic compounds. Improved traditional processing techniques optimized for improved bioavailability and health benefits of phenolics are highly relevant for the low income populations (Gabaza *et al.,* 2016)

Fermentation appears to reduce the presence of iron-binding phenolic groups andphytate; on the other hand, cooking may reduce protein digestibility (Abdelhaleem *et al.,* 2008; Mohammed *et al.,* 2010). The fermentation process was found to cause no changes in protein, lipid and ash contents, but it significantly reduced carbohydrate content. The change in amino acids was varied, glycine, lysine and arginine were significantly decreased during fermentation. Fermentation process significantly reduced the enzymes inhibitors and phytic acid whereas tannin content increased (Osman, 2011)

Fermentation using *L. plantarum* and *L. brevis* as starter culture resulted in reduction in the anti-nutritional content of sorghum thereby enhancing it nutritional composition. Sorghum contain some amount anti-nutrients and should be allowed to ferment properly for at least 3 – 5 days to allow for proper growth of lactic acid bacteria that will help in reducing the anti-nutritional factors present in it. The effects of fermentation at 0, 72 and 120 hours on trypsin inhibitor, protease inhibitor, phytate and tannin, of sorghum were assessed. 69% reduction of trypsin inhibitor; 30% of protease inhibitor; 60% of phytate and 72% of tannin was observed at 120h with L. plantarum used as starter culture while 58% reduction of trypsin inhibitor; 40% of protease inhibitor; 70% of phytate and 56% of tannin was recorded at 120h using L. brevis as starter. The growth of LAB will also inhibit potential pathogens in the fermenting sorghum samples. This is a desirable characteristic of LAB and this probiotic effect can be employed in the production of a good weaning food for infants (Adeyemo *et al.,* 2016)

Soaking can increase flour yield, soft flour texture, and dissolve tannin compounds (Suarni and Firmansyah 2005). A loss of about 40% of iron and 30% of zinc during soaking sorghum (Lestienne *et al.,* 2005). During soaking, fermentation occurs by several types of lactic acid-producing bacteria, such as *Lactobacillus plantarum, Candida crusei,* and *Lactobacillus delbruecki*. Fermentation has a positive effect because it decreases the concentration of phytic acid and tannin (Ohenhen and Ikenbomeh, 2007). Soaking or extracting in aqueous solutions can remove up to 75% of phytic acid, but loss of minerals, vitamins and water-extractable proteins also occurs (Claver *et al.,* 2010) Soaking sorghum

for 20 hours in distilled water reduces phytate content by 32.4%, but also zinc by about 30% and iron reduced by between 28.16% and 40.06% (Afify *et al.*, 2011).

SORGHUM PROCESSED PRODUCT

Sorghum can be processed into semi processed products (intermediate) and processed products. Intermediate products are processing sorghum from seeds into decorticated seeds, flour and starch sorghum. While processed products are ready-to-eat products, such as sorghum rice, dehulled boiled sorghum, sorghum noodle, sorghum bread, sorghum cake, sorghum chapatti, sorghum porridge and syrup.

Sorghum seeds are processed by dehulling until the skin is separated. Sorghum skin especially in seeds that have dark-colored skin, couse the taste of the processed products will be bitter. The content of tannin in sorghum is concentrated in the outermost layer or skin, proved sorghum removal stage can reduce the tannin level up to 75%, from 1.82 to 3.98% to 0.36-1.72% depending on the type of variety (Suarni, 2004a). Sorghum flour is a form of processed semi-finished which is flexible, easy to mix and fortified to improve the quality of nutrition, durable and save storage and distribution space (Widowati and Damardjati, 2001).

Rice sorghum is processed from sorghum seeds and consumed as staple foods using side dishes and vegetables. In the development of local food diversification, sorghum rice can also be combined with other sources of carbohydrates into rice "asorgung", which is rice made from cassava-sorghum-corn. Sorghum tape can be processed from sorghum sorghum and can be continued into solid bracket. The principle of making sorghum tape is sorghum soaked rice (12 hours), drained and steamed half cooked (30 minutes). The water used for steaming is splashed on half-cooked corned beef, stirring and then steaming again until it is finished. The fermentation (0.3%) is done after the cool sorghum rice, and it is consumed for 2-3 days. This process can be continued into solid brem by extending the curing time, to 4 days so that water tape is quite a lot. Tape squeezed, taken sari, then dirnasak until thick and printed flat round, then dried up to form a solid brem (Widowati, *et al.,* 1996).

Sorghum can be processed into a snack bar food products. Flavonoid levels, total phenol, and antioxidant activity of red sorghum snack bar 0.015mg QE/g, 2.508 mg GAE/g, and 53.431%; White sorgh snack bar 0.016 mg QE/g, 1.343 mg GAE/g, and 38.987%; And chocolate sorghum snack bar 0.018 mg QE/g, 4.679 mg GAE/g, and 64.431%. There are differences in flavonoid content, total phenol, and antioxidant activity between sorghum seed and sorghum snack bar. The brown sorghum snack bar contains flavonoids, total phenol, and the highest antioxidant activity compared to the red and white sorghum snack bar. There are differences in flavonoid content, total phenol, and antioxidant activity between sorghum seed and sorghum snack bar. The white sorghum bar snack is most favored by the panelists. The highest levels of flavonoid, total phenol, and antioxidant activity were found in the brown sorghum snack bar of 0.018 mg QE/g, 4.679 mg GAE/g, and 64.431%. Processing sorghum into a snack bar product causes a decrease in flavonoid content, total phenol, and antioxidant activity (Isdamayani, 2015)

Sorghum seeds have a total energy of 4375.94 kcal / kg, water content, fat, fiber, protein, carbohydrate and ash respectively 12.85%, 3.10%, 0.56%, 5.87%, 75.82%, and 1.79%, and C-organic by 12.47%. The optimal result in making the fermented sorghum flour using Yeast Sacharomyces Cereviceae is fermentation time 60 hours with the amount of yeast produced 1.7 x 105 cells / ml with lactic acid 0,214% (Angelina, 2013).

Brown sorghum has the potential to be developed into flour however, the nature of sorghum flour properties that is not resistant to high temperatures, low viscosity and strength of swelling and the limited solubility cause sorghum flour is limited in the use in food industry. To overcome some of the weaknesses of brown sorghum starch properties, it is needed to create modification method of the starch in fermentation one by utilizing all parts of grain sorghum (whole grain) using 'ragi tape'. The function of microbes in 'ragi tape' is expected to improve the natural characteristic of starches so that it can be used for various products of sorghum.Combination of the best fermentation modification

treatment is on 'ragi tape' concentrations of 6% and a fermentation duration of 18 hours with the value of 6.10% water content, 67.36% starch content, 3.03% crude fiber content, 1.94% tannins content, 21.62% amylose content, 56.54% yield, 5.74 pH, 8.86 g/g swelling power, 42.28% solubility, 74.13% brightness, 65.70 °hue and 1840.67 cP viscosity (Armada and Putri, 2016). Kurniadi *et al.,* (2013) reported that 48 hours fermentation period and 6% of *L. acidophilus* starter concentration as the best result for sorghum flour fermented. This sorghum fermented has physicochemical characteristic i.e. 1.365% of soluble protein, 1.278% of reducing sugars, 0.062% of tannin, 39.833 cP viscosity and 22.93 degree of whiteness.

The sorghum porridge can be made from sorghum flour and cowpea beans with a ratio of 75: 25%, and maltosekstrin 4%. Characteristics of sorghum porridge produced: water content 3.26%, protein content 15.01%, 0.55% fat content, crude fiber 4.25%, total carbohydrate 75.74%, total energy 3764.19 cal, water absorption index 17.06% and water vapor absorption 6.63% (Dewanti *et al.,* 1998)

One of the derivative products that can be made from sorghum is flakes. Selected formula consisted of 3.87% sorghum, 29.68% sago, and 17.25% maltodextrin and it had 0.839 desirability value. The verification results showed that the selected formula produced flakes having hardness of 1046 g, total work of 2.26 mJ, digested starch of 64.84 g/100g, lightness of 49.14, and hue of 47.98. The hedonic test results indicated that the selected formula was sensory acceptable at all sensory parameters (color, aroma, texture, taste). The flakes had moisture, ash, fat, protein, and carbohydrate content of 2.86%, 0.55%, 5.40%, 2.06%, 89.14% respectively. These sorghum and sago based flakes have qualified energy as a breakfast food product for children (Putra, 2011).

SORGHUM FOR FOOD SECURITY AND NUTRITION

Sorghum is the fifth largest most important cereal in the world agricultural economy, after wheat, maize, rice and barley, and the second (after maize) in sub-Saharan Africa. Sorghum represents a main source of energy and protein for about one billion people in the semi-arid region of tropics and it is part of the staple diet in developing countries, representing their major source of energy and nutrients (Taylor, 2003). In particular, in Africa, sorghum is a basic staple food for many rural communities, especially in drought prone areas, characterized by shallow and heavy clay soils; thus, it is a subsistence food crop for many food insecure people (DuPlessis, 2008).

Besides providing calories, sorghum has actual nutritional value in principle, because of its content of protein, vitamins (D, E and K) and of B group (except for B12), as well as minerals, such as iron, phosphorus and zinc. In particular, a recent study classifies sorghum genotypes as source of vitamin E but highlight how the analyzed genotypes showed low contents of carotenoids (De Cardoso, *et al.,* 2015). In composition, sorghum grain compares favorably with some other cereals: it has a similar protein content to wheat but higher than maize and rice, while the essential amino acid composition of sorghum is comparable to maize or wheat due to the limited content of threonine, arginine and, especially, lysine. Iron content of sorghum is lower than millet but is higher than wheat, maize and rice (Henley, 2010).

As a further interesting aspect, sorghum is considered suitable for people with coeliac disease and gluten intolerance due to the lack of gluten (Kasarda *et al,* 2001; Ciacci *et al.,* 2007; Schober *et al.,* 2007) Indeed, individuals with coeliac disease may not consume enough dietary fiber; thus, sorghum whole grains could usefully complement their diets. The impact of this aspect, although not currently assessable in developing areas, might be interesting in western populations, where the incidence of coeliac disease and gluten intolerance is an increasing phenomenon. Sorghum might provide a good basis for gluten-free cookies and bread, thus increasing the range of alternative food products available to people suffering from coeliac disease.

Sorghum is important cereals not only as sources of carbohydrates, but also as functional foods. Sorghum contain a variety of antioxidants, mineral elements especially iron (Fe), dietary fiber, oligosaccharides, betha-glucans, including non-starch polysaccharides (NSP) carbohydrate components, making them potential as sources of functional foods. Sorghum contains tannin, phytic

acid that cause the negative and positive impacts on health. The antioxidant properties of tannin are better than vitamin E and C, and anthocyanin antioxidant of sorghum is more stable. These commodities have similarity and superiority in functional food components. During this time, sorghum are only utilized as sources of carbohydrates, but in the future they have to be viewed as functional food components (Suarni and Subagio, 2013)

Sorghum has the potential to be developed as a functional food because it contains gluten and a lower glycemic index making it particularly suitable for special nutritional diets (Siller *et al.,* 2006; Schober *et al.,* 2007). Size-exclusion high-performance liquid chromatography demonstrated that during sourdough fermentation, proteins from the dough liquid were degraded to peptides smaller than kafirin monomers (<19 kDa). Laser scanning confocal microscopy showed aggregated protein in bread crumb without sourdough fermentation, whereas with sourdough fermentation, only small isolated patches of protein bodies embedded in matrix protein remained. In oscillatory temperature sweeps, sourdough fermentation caused a significantly higher resistance to deformation (|G*|) after gelatinization of the above batter relative to batters without sourdough. Results suggest that a strong starch gel, without interference of aggregated protein, is desirable for this type of bread (Schober et al., 2007) Extrudates and porridges had reduced starch digestibilities and EGI values when using whole grains compared to using the decorticated fractions. wholegrain products from sorghum have health benefits attributed to whole grain foods and slower digesting starches; for instance, prevention and treatment of diseases such as diabetes, insulin resistance, obesity, cardiovascular disease, and some types of cancer. The addition of tannin sorghum bran significantly reduced the estimated glycemic indexes (EGI)value of wheat bread, besides being a natural source of brown color, and an excellent source of antioxidants and dietary fiber (Siller *et al.,* 2006).

The highest glucan extract was found in 12% non-steroum sorghum and 5% in sorgum sosoh 20 seconds. The glucan fiber extract had a significant effect on the stimulation index of lymphocyte cell proliferation and was significantly different from the control. The stimulant index for sorghum is 1,714. This indicates that glucan extract from sorghum has immunomodulatory activity and can prevent cancer (Zakariah et al., 2009) Fe mineral element is very helpful in the formation of red blood cells. Sorghum is rich in minerals Ca, P, and Mg (Suarni and Singgih 2002). Ca functions in normal bone formation, phosphorus for maintenance of growth and Mg to maintain normal heartbeat and bone strength.

CONCLUSION

Sorghum is a potential crop and can be relied upon to support the success of the food diversification program which further leads to the world food security. Sorghum grains can represent an ideal crop for the sustainability of the agro-food system. Sorghum is a major grain in the world agricultural economy and represents an important staple food for the populations of many developing countries. The cereal is part of the diet of millions of people, representing for them a major source of energy and nutrients. Strategies for the improvement of sorghum's nutritional value include the reduction of the components (or their activity) causing nutritional concerns, good practices to reduce its liability to toxic contamination by exogenous compounds, and the compensation for its nutritional deficit by following a varied diet. Most of these strategies can be easily put in place by enhancing local knowledge and practices related to sorghum landraces selection, farming practices, storage, processing, and cooking.

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COMPARATIVE COMPARISON OF PRODUCTION FACTORS PADDY CIHERANG AND MEKONGGA ON PLANTING JAJAR LEGOWO 4: 1 IN DISTRICT PANDEGLANG BANTEN PROVINCE

[1*)] Yeni Budiawati, [1)] Andjar Astuti, [2)] Mansyur, [2)] Romi Zamhir Islami

[1)] Agricultural Faculty, Sultan Ageng Tirtayasa University, Indonesia
[2)] Animal Husbandary Faculty, Padjadjaran University, Indonesia

[*)] Correspondence e-mail : yenibudiawati@gmail.com

Abstract

This study aims to: 1). To identify the comparison of rice production factors of Ciherang and Mekongga varieties on legowo planting technology; 2). Analyzing the influence of rice production factors on legowo planting technology. This research is descriptive quantitative with survey method with random sampling of 75 farmers in Pandeglang Regency covering 4 districts of Cibaliung, Cikeusik, Munjul, and Bojong. A total of 44 farmers used Mekongga varieties and 31 farmers using Ciherang varieties. To analyze the effect of production factors using multiple regression analysis with SPSS 16.0 application. The research was conducted in March until June 2017. The results showed that rice production of Mekongga greater compared with Ciherang with a proportion of 56.17% for Mekongga and 43% for Ciherang varieties or for 246,600 kg for Mekongga and 192,400 kg for Ciherang varieties. Average production of Mekongga amounted to 7954.84 kg and amounted to 4372.73 kg for Ciherang. The average capital used for one planting period for Mekongga was Rp 8,311,290, while for Ciherang varieties amounted to Rp 5,455,227. The average chemical fertilizer use on Mekongga varieties is greater than 932.26 kg / ha compared to Ciherang which is only 340.23 kg / ha. The dose of pesticide used for Mekongga varieties averaged 2.36 L / ha while Ciherang was 1.67 L / ha. The number of panicles per clump for Ciherang varieties is 23, while the Mekongga is less that is 22. The use of labor for Ciherang is bigger that is on average as many as 33 people, while for Mekongga 18 people. The average selling price for each variety is the same, which is Rp 3400 / kg for the GKG. The result of regression testing for factors of production that gives the most significant influence is the amount of capital, the dose of chemical fertilizer, and the area of land for Mekongga varieties. Whereas for Ciherang varieties the production factor that gives effect is the amount of capital, while for other production factors do not give real effect.

Keywords : production factor, rice plant, Mekongga, Ciherang, jajar legowo

INTRODUCTION

Guarantee of food availability for the community as outlined in the context of food security is inseparable from the role and responsibility of the government as the policy holder. Various technological and policy innovations are made to ensure adequate food availability for the community. The availability of adequate food will be able to realize food self-sufficiency and ultimately will be able to create food security. Food self-sufficiency is a condition of the fulfillment of food for the state up to the individual, which is reflected in the availability of adequate food, both quantity and quality, safe, diverse, nutritious, equitable, and affordable and not contrary to the religion, beliefs and culture of society, live healthy, active, and productive in a sustainable manner. Various efforts made both by the government and the perpetrators in the agricultural sector to be able to guarantee and increase food availability for the population. Efforts to increase food production mainly rice as staple food of the people of Indonesia continues to be done. But the improvement efforts encountered various obstacles and problems. The frequent droughts and floods in various regions often threaten rice productivity,

declining land productivity, growing pests and diseases. Technological innovation, strategy, and approach of intensification program correlate with the success of productivity improvement (Yeni Budiawati, 2017). The effort to increase main food production of paddy as staple food of Indonesian society continues to be done. However, the increasing effort encounters various obstacles and problems. The frequent droughts and floods Legowo planting technology that is one of the Integrated Crop Management (PTT) programs is one of the approaches developed by the innovative and dynamic Dynamic IAARD (Syamsiyah Gafur, et al, 2016). Some of the key principles of PTT are participatory, site specific, integrated, synergistic or harmonious, and dynamic (Yuli 2008). Components of technology in the management of plants and integrated resources (PTT) is expected to be one of the pillars of the green revolution sustainable (Puslitbangtan 2005) in spurring rice production in the future. Legowo java system has several types of planting, namely type 2: 1, type 4 : 1, type 5: 1 and type 6: 1. Syamsiah Gafur explained that there was 40% increase in production and adoption of jarwo planting technology from 2 ha (2013) to 250 ha (2014) and also the development of New Superior Varieties (VUB) Inpari 6, Inpari 10 and Mekongga 150 ha in Sojol Utara Subdistrict of Donggala District, Central Sulawesi. The research results of Yeni Budiawati, et al (2017) showed that planting distance on the application of legowo java planting technology in Kecamatan Sukadiri Tangerang Regency influenced the plant population. In legowo system 5: 1 with distance planting 25 cm x 25 cm rice plant population reach 126,400 - 208,500 clump / ha, at planting distance 27 cm x 27 cm rice plant population reach 140,000 - 145.000 clump / ha, while at plant spacing of 30 cm x 30 cm obtained by plant population as much 119,800 - 129.600 clumps / ha. The difference of population is due to the uniform size of planting sticks used by farmers. The purpose of this study is to 1) .Identify the comparison of rice production factors of Ciherang and Mekongga varieties on legowo jajar planting technology in four sub-districts in Pandeglang Regency; 2). Analyzing the influence of rice production factors on planting technology of row legowo with multiple linear regression analysis tools, as well as describe the differences of legowo system in improving productivity in two types of rice varieties: Ciherang and Mekongga.

RESEARCH METHODS

This research is a descriptive quantitative research using primary data. Primary data was obtained by taking random samples and interviews to 75 farmers spread over four sub-districts in Pandeglang District, namely Bojong, Munjul, Cikeusik, and Cibaliung sub-districts which applied legowo4: 1 row planting technology. This primary data is data of farmer characteristics and data of factors of production. The respondent characteristic data include name, age, gender, education level, land area, and land ownership status. Production factor data include fertilizer dose, pesticide dose, land area, selling price, number of panicles and number of production for one harvest. This study compared two types of rice field varieties. Ciherang and Mekongga varieties using a questionnaire distributed to 75 rice farmers.

The data of the questionnaire were compared and analyzed descriptively to describe the different characteristics of each varieties. Furthermore the data of the factors of production were analyzed using SPSS 16 to get the effect of these factors of production on rice production by using multiple linear regression analysis. productivity is described to illustrate the productivity level of rice paddy. The regression equation model is

$$Y = a + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + b6X6 + b7X7 + b8X8 + b9X9$$

Y = Production (kg)
X1 = Farmer ages (tahun)
X2 = formal Education (tahun)
X3 = capital for 1 planting (Rp)
X4 = Fertilizer Dose (kg)
X5 = Pestiside Dose (liter)

X6 = malai (buah)
X7 = Worker (HOK)
X8 = Price/kg (Rp)
X9 = Land area (ha)

RESULTS AND DISCUSSION

Mekongga and Ciherang are varieties commonly used by rice farmers in Pandeglang District. Although there are other varieties such as IR 64 but not many. The reason farmers use these two varieties is because of their high production, excellent grain and rice quality, and resistant to climate change and pest attacks. Based on primary data taken in the field characteristics of paddy rice farmers who use these 2 varieties indicate a significant difference, especially in terms of land tenure status, where for Mekongga varieties 100% of land used for cultivation is self-owned. Unlike the case with farmers who use 57% Ciherang varieties are self-owned land, the remaining 43% are farmers with tenure of land is rent. The yield of rice crops for both varieties is mostly farmers sell it to the middleman> 90%, while <10% of farmers sell their own to the market or consumers directly. Data characteristics of these 2 varieties can be seen in Table 1 below.

Table. 1. Farmer Characteristic Data based on Varieties Used in Pandeglang District

Variety	Ages Average (years)	Formal Education (years)	Land Ownership (%)	Market
Mekongga	48	7	100% (self own)	96,8% (middleman) 3.2% (direct selling)
Ciherang	46	8	57% (self own) 43% (rental)	90.9% (middleman) 9.1% (direct selling)

Source : primary data (2017)

From 75 wetland paddy farmers using Mekongga and Ciherang varieties have an average age of 46 - 48 years with a duration of 7 to 8 years of formal education or equivalent junior high. Comparison of Rice Field Production Factors of Mekongga and Ciherang Variety on Jajar Planting Technology Legowo 4 : 1. Cibaliung, Cikeusik, Munjul, and Bojong sub-districts are the locations of the Special Effort (Upsus) implementation in Pandeglang District, with one of its programs being the application of legowo java planting technology. These areas are also the center of rice production in Pandeglang Regency with the use of land area of 1,671 ha. Most of the farmers in this research area use Ciherang or Mekongga varieties. Legowo type applied by farmers varying from 2:1, 4:1, 5:1, to 6:1.

The legowo row planting system produces the optimal clumps of plants to produce more panicles per unit area and potentially yield higher yields. In addition, the healthy and uniform growth of plants to accelerate the soil surface closure so as to suppress weed growth and increase plant resistance to pests and diseases (Yuti Giamerti and Zuraida Yursak, 2011). Researchers chose planting with jarwo 4: 1, because most use 4: 1 with spacing of 25-30 cm. The seeds used by farmers are subsidized seeds of 25 kg / ha, using Urea, SP-36, organic, NPK Phonska, and Carbofuran. Provision of fertilizer is done at the age of planting 7 - 15 HST and 30 - 50 HST.

The result of research of Marina F Rumagitet.al (2016) which compare 4 varieties of rice, Ciherang, Mekongga, Cigeulis and Suluttan Unsrat 2 in Tincep Village of Minahasa Regency showed that the appearance of rice, Ciherang, Cigeulis, Mekongga, and Suluttan Unsrat 2 in characters Weight 1000 grains (gr), Weight of harvest grain (kg), Weight of dried grain (kg), Number of unhulled grain, and Number of unpaid grain. Overall, the varieties tested showed relatively similar results in the five

observed character traits. Different varieties did not cause differences in the five observed outcome characters.

When compared with the results of research conducted in 4 sub-districts in Pandeglang district with the use of 2 varieties of rice that is Mekongga and Ciherang with the use of row legowo4: 1, the comparison of production factors used between Ciherang and Mekongga varieties is shown in Table 2.

Based on the data in Table 2 it can be seen that the average production of rice for Mekongga varieties is greater than that of Ciherang variety, as well as the average capital, fertilizer doses, and pesticide doses used. This is due to the average land area used for rice farming on Mekongga varieties is also greater than Ciherang varieties. But the use of labor (HOK) for rice cultivation of Ciherang varieties is even greater than the Mekongga. This is due to the ownership of land for farming on Mekongga varieties 100% is self-owned, so farmers are more concerned about capital efficiency in the production of farming, although the area of land used is greater. The amount of panicle is relatively not very different in terms of number in both rice varieties. Primilestari et.al (2015) Primary study shows that the 4: 1 legowo jajar system treatment has significant effect on the number of tillers, while the varietal treatment has no significant effect on the number of tillers. The number of tillers will affect the number of panicles per hill. Different studies were produced by Serlyones Kafisa et al (2016) which showed that planting system had no significant effect on the number of tillers 2-7 After plant, the varieties had significant effect on the number of tillers 2, 3 and 5 after plant and interaction both have a significant effect on the number of tillers 2, 5, and 6 after plant. The same is not unlike the selling price between the two varieties, in the form of GKP 2 rice varieties are sold for Rp 3400/kg. Results of Multiple Linear Regression Analysis on Wet-rice Production of Mekongga and Ciherang Varieties.

Table 2. Comparison of Average Production Factors on Mekongga and Ciherang Rice Paddy Varieties through Jajar Legowo 4: 1 Planting Technologies in Pandeglang District

Varieties	Total Production (kg)	Capital (Rp)	Fertilizer dose (kg)	Pestiside dose (liter)	Malai	Worker (HOK)	Selling price (Rp/kg)	Land area (Ha)
Mekongga	7954.84	8311290	932.26	2. 36	22	18	3400	2.15
Ciherang	4372.73	5455227	340.23	1.67	23	33	3400	1.15

Production factors affecting the production of Mekongga and Ciherang varieties were analyzed using multiple linear regression. From result of multiple linear regression analysis obtained result that there is negative linear correlation between production with age of farmer, amount of panicle, amount of labor, and selling price. As for other production factors, such as the length of farmers taking formal education, the amount of capital per 1x planting, fertilizer dose, pesticide dose, and land area have a positive linear relationship, which means that the higher the production factor, quantity of production factors, then the lower the amount of production. The data is shown in Table 3.

Based on the data in Table 3, the production factors that significantly affect the production of Mekongga varieties are the amount of capital for 1x planting season and the fertilizer dosage at 5% confidence interval, while the land area significantly influences the 10% confidence interval. However, all factors of production together significantly affect the amount of production in Mekongga rice field varieties. The data in Table 4 shows that age, length of farmers taking formal education, amount of capital, fertilizer dose, pesticide dosage, number of panicles per hill, number of labor, selling price and land area do not give significant effect to Ciherang rice production as well as all the factors of production together-have no real effect. The results of the study of Suci Primilestari and Syafri Edi (2015) actually showed slightly different results by using analysis of various research results showed that interaction between superior varieties and planting system significantly affected the production, both GKP and GKG.Perapan planting pattern jajar legowo 4: 1 can increase production GKP varieties Inpara 3 and Ciherang. The highest average GKP yield was obtained on Inpara 3 varieties with a 4: 1 legowo jajar system treatment, ie 6.61 ton.ha-1. Legowo row system treatment can increase the production of GKP up to 11% compared with tegel system. Delima Napitupulu (2015) research result

shows that Mekongga rice varieties provide good adaptation with dry yield of 8.2 t / ha.Varietas Mekongga shows an agronomic appearance better than other varieties. It is in line with this study that the average production rate for Mekongga varieties is much greater when compared to Ciherang varieties.

Table 3. Regression Coefficient Analysis Results on Mekongga Varieties

Model	Unstandarized Coefficient		Standarized Coefficient	T	Sig.
	B	Std. Error	Beta		
1 (Constant)	1361.471	6334.603		.215	.832
Ages	-36.253	39.761	-.044	-.912	.372
Formal education	186.444	164.249	.063	1.135	.269
Capital per 1 planting	.001	.000	.815	11.184	.000
Fertilizer dose	1.219	.374	.210	3.259	.004
Pestiside dose	153.297	338.609	.028	.453	.655
Malai	-58.841	80.156	-.047	-.734	.471
Worker	-18.365	23.485	-.041	-.782	.443
Selling Price	-.223	1.416	-.010	-.157	.877
Land area	260.927	137.903	.096	1.892	.072

Table 4. Analisys of regression to Ciherang varieties

Model	Unstandarized Coefficient		Standarized Coefficient	T	Sig.
	B	Std. Error	Beta		
1 (Constant)	-1871.827	7756.488		-.241	.811
Ages	-81.801	79.445	-.191	-1.030	.310
Formal education	-83.521	235.026	-.059	-.355	.725
Capital per 1 planting	.000	.000	.581	2.036	.050
Fertilizer dose	-.044	4.159	-.002	-.011	.992
Pestiside dose	-6.967	6.275	-.173	-1.110	.275
Malai	15.355	101.085	.023	.152	.880
Worker	-12.534	23.389	-.128	-.536	.596
Selling Price	2.487	1.549	.308	1.605	.118
Land area	-90.245	533.797	-.034	-.169	.867

Based on the data in Table 4 the results of multiple linear regression analysis conducted on Ciherang varieties there is no capital production factor that gives a real effect on the 5% or 10% confidence interval, while the factors of production together also have no real effect on the amount of production. The result of regression coefficient analysis shows that for production factor of age, formal education of farmer, dose of fertilizer, dose of pesticide, amount of labor, and land area show negative direction of relationship, which means that the higher production factors will decrease and vice versa . Factor production for capital has no linear relationship, while the number of panicles per hill, and the selling price indicates the direction of positive relationship, which means the higher the number of production factors, the higher the number of production and vice versa. The regression equation model for Ciherang varieties is:

Total Production = -1871.827 –81.80X1 – 83.52X2 – 0.44X4 – 6.97X5 + 15.36X6 – 12.53X7 + 2.49X8 – 90.25X9

Information :
X1 = Ages of farmers
X2 = level of formal education

X4 = fertilizer dose
X5 = pestiside dose
X6 = total of malai
X7 = quantity of workers
X8 = sell price
X9 = land area

As for the results of regression coefficient analysis of Mekongga varieties generated regression equation as follows:

Total production = -1361.47 – 36.25X1 + 186.44X2 – 0.001X3+ 1.22X4 + 153.30X5 + 58.84X6 – 18.37X7 -0.22X8 +260.93X9

information :
X1 = Ages of farmers
X2 = level of formal education
X4 = fertilizer dozes
X = Capital
X5 = pestiside dozes
X6 = total of malai/rumpun
X7 = quantity of workers
X8 = sell price
X9 = land

CONCLUSIONS

The level of rice production is technically determined by the ability to manage the four components of farming technology, namely the use of seeds, fertilizers, pesticides, and labor. On the other hand, the production earned greatly determines the amount of income, while the income level is influenced by the cost of production and the selling price. In rice farming using Jajar Legowo planting technology using 2 varieties of rice paddy field that is Mekongga and Ciherang show higher average production level for Mekongga varieties compared with Ciherang.Begitu also with amount of capital, dose of fertilizer, dose of pesticide used, and wide land. Meanwhile, for the analysis of the effect of production factors on Mekongga varieties, the amount of capital, fertilizer dosage, and land area give a significant effect on the amount of production on the 5% and 10% confidence intervals as well as all the factors of production have real effect. Analysis of the influence of factors of production either individually or together does not give a real effect on the amount of production in the confidence interval of 5% and 10%. This is more due to genetic factors that affect the level of production in Ciherang varieties.

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IDENTIFICATION AND CHARACTERIZATION OF LOCAL FOOD INGREDIENTS OF BADUY ETHNIC TO SUPPORT FOOD SECURITY

[1*)] Kartina AM, [1)] Dian Anggraeni, [1)] Fitria Riany Eris, [1)] Mirajiani, [1)] Dodi Hermawan, [1)] Alimuddin

University of Sultan Ageng Tirtayasa, Indonesia

*) Correspondence e-mail: kartina_plg@yahoo.com

Abstract

The food production of Baduy area is always surplus, because they store partially of the grain in the barn or house leuit. Baduy ethnic food security is strongly influenced by the environmental resources of the forest. The research used a survey method using snowball sampling. Based on the findings of research that the food staple of Baduy consisted of rice as primary food, vegetables (Hiris vegetable, Mantang vegetable, bamboo shoots vegetable) and fish, especially anchovies. Several types of Baduy local food are wajik, Opak, Uli, Rengginang, Tape, Gipang, Gemblong, Ulen, Getuk Dangdeur, Getuk Cau, and Wijen. The drinks that many consumed were sugar ginger, acid keranji, and wild honey as a local typical product. Other food ingredients non-rice were cassava, yams and taro. Baduy food handling typically was stored in the storage barn or house of leuit as part of the efforts to ensure food security of local ethnic Baduy.

Keywords: Baduy, Characterization, Identification, Food Security, Local Food,

INTRODUCTION

Based on Indonesia constitution number 18, by the year 2012 (UU RI No.18/2012) about Food, it is stated that many things concerning with food security system is organized by the constitutioan, and the Province Government has its own role to create national food security. The province government has an important role since the system of food security is developed by the source of local food in order to fulfill the needs of national food security. The availability of local food sources in supporting the system of food security should be optimized so that it can be consumed by society.

Indonesia is facing a big challenge in developing food security, because of cultural conception of food and varieties of ethnic or traditional food. It happens since the society or particular ethnics group has its own system and specific ecological system.The social cultural system and ecology that they owned will create food security and specific nutrients which can be learnt interestingly.

Several tribes will choose the specific food sources not only based on nutrients level, but also considering the self-identity and the symbolic functions, values, and trust. Ethnical group of people need to understand the concept of food security. Every ethnics group has role in proposing the opportunity, difficulty, and challenge in the process of food diversivication and food security.

Baduy tribe is a tribe spreaded around Banten Province. The most dominant ethnics group has its own various food diversity, both as *food stuff* and also food crops in producing and creating food security in each small town.

Baduy tribe is an original tribe which still runs their own faith and basic cultures. Eventhough the surroundings has been developed and changed because of modernization, the Baduy people keeps their own faith, habits, and basic cultures survived.

Baduy people live at *Kendeng* Mountains (the height is about 300-600 metres. above sea-level. It is located in *Kenekes* field, Lewidamar, Lebak-Rangkas Bitung District, Banten Province and about 40 km from Rangkas Bitung Districts.

Baduy society has special tradition called *Pikukuh. Pikukuh* tradition still works in *Baduy Dalam (tangtu),* while *Baduy Luar people (panamping)* do not really do *pikukuh tradition.* Baduy people have

produced their own local food autonomously long time ago, and nowadays it is called as implementation of food security in Indonesia.

Life principles of Baduy people is autonomy, they keep their faith to protect the origin of their tribes and natural environment. Baduy tribe society has been developing food security by planting their field without destroying natural environment nearby. They plant rice field around the hills and keep protecting the natural environment by giving more attention to water conservation as what their ancestor did long time ago.

Food security in Baduy Tribe is influenced by the natural forest resources. Baduy tribe has great natural resources, and they are processing their natural food related to natural resources in the forest. Since some Baduy people interact with common people surroundings their village, recently they are introduced with cooking utensils and modern additive food, but they still keep their special tradition, their food still use traditional natural resources. The main food of Baduy local food are rice, fish, and vegetables taken from the forest and field surroundings their home. The rice is cooked by using "tungku" or traditional stove using burnt woods. The rice being consumed is harvested rice, the rice is cooked by using a pan on the burnt woods. The exploration of local food resources from Baduy is very important and need to be introduced to our new generation as cultural inheritance.

Suryana (2005) stated that food security can be built strongly in every houses based on varieties of local food resources. As an effort to reach food security in Indonesia, food variety will be one of solution to overcome the limitness of food in the society, house or family environment, and individual. Many efforts have been done by family or society to prepare the availability of food for each person in the family and surroundings. One of the efforts is producing their own food in their own field or farm, or buying food in the traditional market or small warong in their surroundings (Khomsan 1993).

It is needed more research in identifying and characterizing local food based on cultural condition; how Baduy people eat, and how they can survive in the limitation of food. It is hoped that the result of the research can give a great contribution in developing staple food resources in order to establish national food security especially in the traditional tribes in Indonesia. The purposes of the research are identifying and and characterizing local food of Baduy tribe based on local wisdom in order to reach food security of Baduy Tribe in Banten Province.

RESEARCH METHOD

The main focus of the research is identifying local food of Baduy tribe in Banten Province. The subject of this research is called informant. The method of choosing the informant focused on the data being searched, such as information related to local food of Baduy tribe. The informant is chosen purposively through snow ball sampling. Snow ball sampling is a technique of gathering data from limited number of informants to be developed into big number of informants based on recommendation from the previous subject about the informants. The informants are from Baduy, those are *Baduy Dalam* and *Baduy Luar* who live in Lebak district of Banten Province.

Data collecting technique of this research is through explorative survey method and in-depth interview with open-ended questions. The researchers also did a field observation and interview. Identification of local food culinary of Baduy tribe through data primer collecting by interviewing Baduy people related with preparing the resources of local food, processing the local food, until serving the local food and ready to be consumed.

The secunder data are written documents related with special tradition, habits, and daily life of Baduy people concerning with local food culinary, such as historical books, monographs and other research results available. Data Validity is examined through triangulation method. Informant triangulation was done through Focus Group Discussion (FGD) by the end of data collecting in the research site.

The aims of the research is identifying food culinary of special local food in Baduy tribe, covering the composition of raw food sources, additional food sources, the tools being used, the food

processing, and the amount of food being served. The method of the research is descriptive qualitative through data reduction, data description, and conclusion. The data is analyzed manually through transcription and matriculation. The last stage is data analysis by comparing information from the informant with the available theory, and then classifying the data to take the final conclusion.

RESULTS AND DISCUSSION

General Description of the Research Site

Kenekes village is one of village located in Leuwidamar, Lebak District, Banten Province. Geographical area is about 38 km from Rangkasbitung (the capital city of Lebak Districts). It is also 65 km from Serang (the capital city of Banten Province) and it is in the area of South Banten. The government has stated that *Kanekes* Village (*Kendeng* Mountains) is Culture Conservation. The wide of *Kanekes* village is 5101,85 hectare. It is a home of Baduy tribe society. They live in a remote area on the mountains. It is 100 km from Jakarta. (Provinsi Banten, 2002). The area is the inheritance lands from ancestors of Banten. People are to protect, guard the lands properly, and cannot be owned by individual, so it had been declared as belong to Baduy tribe society. Baduy tribe has a great and famous culture, so that the tourists from out of town and foreigner tourists really like to come and visit *Baduy Dalam* and *Baduy Luar* society. The tourist come to Baduy for natural holiday and also for doing a scientific research, (Langdon, 2003).

Kanekes has 65 Villages (Kampong). Baduy tribe people live in the three villages, they are *Cibeo, Cikeusik* and *Cikartawana Kampong*, it is called as *Baduy Dalam*, while *Baduy Luar* people live in 62 villages. Baduy tribe society has special law custom, they have to follow their *Puun* (*Puun* is the leader of Baduy society) from *Cikertawana* and *Cibeo*. The *Puun* has eight (8) assistances which have the same responsibility, it is called *Joro.*

Most Baduy tribe people live as farmers who plant rice in the rice field *(Huma)*. They also plant some other vegetables and fruits in the field or yard. Some of them also work as craftsmen, such as; Koja Craftsmen, woven fabric, knitted product (sling bags), and brown sugar producer. Their religion is *Sunda Wiwitan*, they believe in one God, *Hyang Tunggal* as the creator, the arranger and the determinant of life, (Ekadjati, 1993).

Types of Processed Food in Baduy Tribe Society

Production of rice in Baduy society can not fulfill their everyday needs, since some of harvested rice being consumed not only for family but also for traditional tribe ceremony (the rice is given to parents, *Jaro, Puun*). The rest of harvested rice is stored in the barn *(leuit house)* for their daily needs. Baduy people sometimes buy other staple food from warong or small shop and market nearby their society if their food storage getting limited. The closest market is Ciboleger town market. They can reach Ciboleger town market by walking. The market is very near with Kampong Kaduketug 3 (the out of Baduy area). Ciboleger village is a place where Baduy people shop and interact with other society. They can buy their daily needs and staple food, such as rice, vegetables, salted fish and noodle. The bus station also in Ciboleger village.

The farthest market from Baduy is located in Rangkas Bitung. It took 2 hours to Rangkas from Baduy *(Baduy Luar-Kampong Kaduketug 3)*. Baduy people go shopping for a few food because actually they already have their own stoored food in *leuit house* or barn. They usually go to the market early in the morning before dawn, and go back to their village before lunch time. They go and back to the nearest market on foot for three hours. The main food of baduy society are rice, cassava and corn. All Baduy people plant rice, corn, and cassava. They also plant vegetables such as *petai, jengkol*, cassava leaves, hiris nut vegetables, nut, jaan, cucumber, and eggplant. Only a few of food that they buy from market, such as salted fish, fresh fish, chicken, tofu, tempe. They plant those vegetables in their field nearby their houses. They cannot plant spinach and *kangkung* since they need more attention in planting them. They also plant some fruits tree, for example papaya and banana. The

followings are kinds of bananas they plant in their field: Ambon banana, Raja banana, and Tanduk Banana.

Traditions, habits, and culture create the people's thoughts and emotion. Through culture, people also learn to fulfill their basic and biological needs. Culture also determines the way the people eat, what to eat, when to eat, and what kind of food that is forbidden for them. It also works in Baduy tribe, they develop social culture of local food that reflect how they consume their food in their social community. Culture also leads their faith and moral in the society, (Aspartia, 1996).

Food is the basic needs of all human being, we cannot live without food. Our body needs good food as source of energy, runs our metabolism and help us grow. Food also an element of culture, not only for its nutrients, but also for it tastes, colour, and the form of food when it served well, (Soemarwoto, 1991). Eating habits in one society is different to other people from other society. The differences of eating habits because of the differences of cultural components in the society. Eating habits in the society plays an important role in building the eating habits in each home of a family. As stated by Soehardjo (1989), Every society has its own culture. As *Baduy Dalam* and *Baduy Luar* have different habits with other people outside of their community in consuming their food. There are several food that they processed and consumed based on their tradition and culture.

Baduy tribe creates their own processed food by using local food resources in their own surroundings. These are various kinds of local food processed in Baduy tribe society :

1. Wajik. This is a special food of Baduy tribe society. Wajik is always present in every occasion comparing with other kinds of processed food in Baduy society. The ingredients needed are as follows: sticky rice, brown sugar and coconut. The followings are the process of cooking Wajik: wash the sticky rice cleanly. Put them in the big bowl or soak with water for 2 hours. Steam the rice until it is well done. Grated the coconut and then fry the grated coconut in the frying pan without oil cooking. Put the slices brown sugar into the frying pan. Put the steamed sticky rice into the frying pan and stirr it evenly until it is not sticky anymore. And then, take out the sticky rice dough and wrap it in small pieces by using banana leaf. The Wajik is ready to serve.

Figure 1. Wajik Baduy

2. Uli. This is also a special processed food of Baduy tribe society. The ingredients neede are as follows: soak the rice in a big bowl with water for one night, and then wash it cleanly. Steam the rice until it is done. Prepare a grated coconut in a big bowl and mix with some salt. Put the steamed rice into the big bowl with grated coconut in it. Mix and stirr it evenly and then pound it until it is soft and smooth. After that mold it as you like it. You can serve *Uli* sticky rice by frying it. The *Uli* is ready to serve.

Figure 2. Sticky Rice *Uli molded* in banana leaf (Uli Ketan)

3. Rengginang. Rengginang is a common food processed by Baduy Dalam and Baduy Luar People. The ingredients are as follows: sticky rice, garlic, and salt. The following is the process of making Rangginang: wash the sticky rice until it is clean. Put the rice in a big bowl with water. Soak the rice. Prepare a steam pan, put water into a steam pan. Put the steam pan on the stove wait until the water is boiling. After that, put the rice into the steam pan. Steam the rice until it is half done. Boil some water in a small pan, pour garlic and salt into the boiling water. Mix the sticky rice with garlic and salt. Then, steam the rice again until it is well done. Mold the sticky rice into a molding tray (it can be round molding or as you like it). After that, put the molding sticky rice under the sun light until it is dry. After it has dried, fry it in the frying pan. Rangginang is ready to serve.

Figure 3. Rengginang of Baduy Local Food

4. Sticky Rice Tapai. The ingredients needed: sticky rice, yeast (fermentation), suji green leaves, sugar. The process of making the sticky rice Tapai as follows: wash the sticky rice cleanly, and put in inside the water for 8 hours. Wash the rice cleanly, and take it out from water. Steam the sticky rice until half done and then put it in a big bowl. Pour slowly hot water into the sticky rice and then steam it again until it is well done. Take out the sticky rice and pour it on the tray until it

is cold. After it is cold, pour the yeast and sugar evenly. At last, wrap the sticky rice tapai with banana leave. Put the wrapped sticky rice tapai into a big bowl and let it stays for 3 days to be fermented. Finally, The Sticky Rice Tapai is ready to serve.

Figure 4. Sticky Rice Tapai of Baduy Local Food

5. Gipang. The ingredients are: sticky rice, sugar, water, vegetable oil, *asam cuka* or vinegar. The following is the process on how to make Gipang crunchy. Put the sticky rice in water for a whole night, and then clean the sticky rice in the morning after staying in the water for a whole night. Then steam the sticky rice for 30 minutes. After that put the steamed sticky rice in a big flat tray made of wood, try to spread the sticky rice so that it will not stick to each other. And then, sunburn it under the sun light until it dries. Heat the oil in a frying pan, put the dried sticky rice into the frying pan by using frying scoop. While putting the frying scoop into the frying pan, try to stirr it slowly. After frying the dried sticky rice, put it into a tray. Then, pour sugar into frying pan without oil, keep stirting the sugar in the frying pan until it is done and pour some acid water or vinegar slowly with a very low level of fire gas stove. Fry it until it curdled *(mengental)*. Make sure that all sugar was curdled. And then pour the fried sticky rice and mold it in the molding tray. It is done, then try to cut it into small pieces or into four part. Gipang crunchy is ready to serve.

Figure 5. Gipang of Baduy Tribe

6. Cassava (Dangdeur) Getuk. Getuk is a special local food of Baduy that is served in special moments. The ingredients are Cassava and salt. There are some steps of making Getuk Cassava: first, peel off the Cassava and then wash it. Steam the cassava until it is done. Take out the steamed cassava, and punch the steamed cassava until it becomes starch, then add some salt. Mold the starch cassava as you like. Dangdeur Getuk (Cassava Getuk) is ready to eat.

Figure 6. Cassava *(Dangdeur)* Getuk of Baduy Tribe

7. Getuk Cau Panggalek *(Getuk Panggalek Banana)*. The Ingredients needed are: Four Bananas *(Panggalek Banana)*,and salt as you like it. How to make it: Peel off the banana and then roast it until it is done. After it is well done, punch or pound it until it becomes smooth and pour some salt and rice, mix them until it mixtured. Finally, the Getuk Banana is ready to serve.

Figure 7. Panggalek Banana Getuk of Baduy Tribe

8. Ginger drinks. The special drink of Baduy tribe is made of Ginger. The ingredients are: Ginger, brown sugar *(gula aren)*, and hot water. How to make ginger drink: Peel of the ginger and clean it, boil some water. While boiling the water, roasted the ginger for a while, and if it is done, you can cut the ginger into small pieces and then punch them so that the smell of roasted ginger comes out. Put the roasted ginger into a glass and pour hot water in it then stirr it evenly. The ginger drink is ready to drink.

Figure 8. Ginger Drinks as Special Drink of Baduy tribe

9. Hiris nut Vegetable soup. This is a special vegetable soup of Baduy tribe. The ingredients are: hiris small nut vegetable, sugar, salt, and *Honje* flower. The process of making hiris soup: Wash the Hiris small nut, and then boil it. Pour sugar and salt in the boiled Hiris. After that, wach Honje flower and boil the honje until it was done. Then, put the boiled Hiris and Honje into a bowl. The hiris soup is ready to serve.

Figure 9. Hiris Nut Vegetable soup

10. Dodol. Dodol is a special food in Baduy tribe, the ingredients of Dodol are: brown sugar, rice flour, coconut milk. The process of how to make it: slice the brown sugar into smal pieces, stirr it evenly, and pour coconut milk accordingly and then stirr it slowly until sticky. If the dough is not sticky anymore, take it out and wrap it in a plain plastics. Special Dodol of Baduy tribe is ready to eat.

Figure 10. Special Dodol of Baduy tribe

CONCLUSION

1. Local food of Baduy tribe are *wajik, uli, rengginang, tape ketan, gipang, getuk dangdeur, getuk cau panggalek, ginger drinks, hiris nut vegetable, dodol.*
2. Based on the result of identification, local food of Baduy tribe can subtitute main food in the future so that it can support the food security in Indonesia.
3. A brief information about the numbers of nutrients in local food of Baduy tribe is not available yet.

SUGGESTION

1. Local food of Baduy trribe has its own history and uniqeness so that it can be developed into the main food of special local food in Banten Province and promoted commercially.
2. The reseearcher needs to identify and analyze the composition of numbers of nutrients in the local food of Baduy tribe.
3. Small business in the local food of Baduy tribe industry need to be developed to become excellent products.

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THE ADSORPTION CHARACTERIZATION OF UREA AND CREATININE SIMULTANEOUSLY ON THE MOLECULARLY IMPRINTED POLYMERS DUAL TEMPLATES

[1*)] Irhamni, [2)] Gunlazuardi J, [3)] Wibowo R

[1)] Department of Chemistry of Faculty of Teacher Training and Educational Sciences University of Sultan Ageng Tirtayasa Banten
[2)] Department of Chemistry of University of Indonesia

[*)] Correspondence e-mail : irhamni_ee31@yahoo.co.id

Abstract

The research about *molecularly imprinted polymers* (MIPs) improved significantly, especially for it's benefit as adsorbent. It happened because MIPs has high selectivity and it's preparation is easy and cheap. The aim of this research is to synthesize MIPs and use it as adsorbent at urea and creatinine adsorption. The research started with graphene syintesis from graphite, MIPs preparation, determine the optimal condition and characterize by IR, XRD, and SEM. MIPs syintesize succesully using chitosan material composited with graphene as its polymer and using urea and creatinine as its templates. The ability of MIPs adsorption for urea and creatinine increase gradually and comparable with the increasing of the concentration and time interaction with analyte. MIPs adsorption mechanism for urea and creatinine is happened through hydrogen bonding at pore print of MIPs compound.

Keywords : *Molecularly Imprinted Polymes*; adsorption; urea; kreatinin

INTRODUCTION

Urea and creatinine are compounds which produced by methabolism in human body as the indicator to determine the function of the kidney whether is the healthy or not. The normal level for urea and creatinine is 15 – 40 mg/dl and 0,5 – 1,5 mg/dl. The function of kidney is in trouble if the urea and creatinine is up the normal level. This condition was happened because gromerular filtration rate decreased so the urea excretion is disturbed.

Checking urea and creatinine level is the important factor to determine the function of kidney. It is needed the quick, accurate, easy and cheap analysis method to determine urea and creatinine in blood serum and urine.The first method that the used to determine urea and creatinin level is colorimetry method. This method based on the complex reaction betwen creatinine and picric acid. The colour that produced of this reaction is the changing of red become yellow (Jaffe reaction). For checking urea level, it is used urea and diacetyl monoxime. The weakness of this methods are low of selectivity because it can be reacted with other compounds which have the same size, and it reaction need a lot of time and the cost is expensive.

The other method that people use to determine urea and creatinine level is chromarography method (Radomska et al. 2012). After analyzed, chromatography method gave a lot of benefit, it has resolution and the high limited detection that can be gathered with other automatic detection system. But, it also has weakness that need more time, the tool is expensive and the complicated procedure (Radomska et al. 2012).

Biocensor method is the new method to determine urea and creatinine level in which used enzyme, cell, antibody and other receptor molecule as bioreceptor. This method is connected to the transducer to read the signal as the result. The excellence of this method is high selectivity and sensitivity.The weakness of this method is the process of immobilization of bireceptor is difficult and bioreceptor stability is low (Sergeyeva et al. 2013)

Molecularly Imprinted Polymer (MIPs) is polymer that formed using molecule imprinting technique. It is syntetic polymer preparation technique used specific binding betwen template molecule and polymer to produce compound as specific analyte. The excellence MIPs compound has afinity bond that the condition is better than other identifier molecule. It is also has high endurance and stability for chemical and physics condition in comprehensive range, and it is easy in synthesis process (Merkoci et al. 2002).

The first step of MIPs is making reaction betwen template and functional monomer, so there is interaction through covalent bond and non covalent bond. Next, there is self assembly process and polymerization in functional monomer and poymer-template complex as the result. It is added cross linker to keep stability of bonding abd mechanics. The last process of MIPs preaparation is template extraction from polymer-template complex using solvent that suitable to the character of it's template.

Laksmi et al.(2006) had finished to synthesize and MIPs compound to make adsorption creatinine wish using melamine and chloranil. Sergeyeva et al, (2013) developed MIPs to measure the level of creatinine in serum and urine that using methacrylate acid as functional monomer and its cross linker. The result of MIPs compound is used as receptor and biocensor. Biocensor is designed to have limited detection and linearity continously as 0,25 mM and 0,25-2,5 mM and can be used for one year.

Materials and Reagents

Chitosan with a degree of deacetylation (DD) of 79% was sup-plied by Sigma–Aldrich Chemical Co., (USA). Graphite, 30% H2O2, KMnO4, Hydrazine, and glacial acetic acid were purchased from Sigma–Aldrich Co., (USA). Hydrochloric acid was obtained from Samchun Pure Chemical Co. Ltd. (South Korea). H_2SO_4 was obtained from Matsunoen Chemicals Ltd. (Osaka, Japan). Deionized water of con-ductivity 20 _S/cm was generated in the laboratory. All chemicals were used without further purification.

RESEARCH METHOD

Graphene preparation

Graphene was prepared from natural graphite by the well-known Hummers method. Amount of 3 gr graphite powder added 6 gr $KmnO_4$. Then added 46 ml H_2SO_4 98% mixed gradually about 2 hours in 35 ^oC. Next, the result of the solution is added 100 ml miliQwater and mixed for 20 minutes in 100 ^oC. Next, the solution is added 10 ml H_2O_2 30 % mixed for 15 minutes and then Keep in the room temperature. Then, the solution is centrifuged for 30 minutes and separated its residue and supernatan. Residue is washed with 10 ml HCl 5 % and 10 ml miliQwater to repeat 3 times. Then it's vacuumed in 50 ^oC for 1 night. The result of the product is browning solid, graphene oxide.

Amount of 50 mg browning solid is soluted in 50 ml milliQwater and mixed for 1 hour. Next, 1 ml hydrazine 85 % is added and heated in 90 ^oC for 1 hour until the colour of mixture is black. Then, the mixture is washed into 10 ml milliQwater to repeat 3 times and it's vacuumed in 50 ^oC for 10 hours and the result of the product is black graphene.

Preparation of Molecullrly Imprinted Polymers (MIPs)

Amount of 0,05 gr graphene is mixed into 10 ml chitosan solution 2 gr/L and mixed under ultrasound for 30 minutes. After that, the mixture is devided into 2 portions. Then, each portion is added into urea 10^{-3} M and creatinine 10^{-3} M and it's ultrasonicated for 30 minutes. Then, both of those mixture is added 5 ml threepolyphosphate 1 % and ultrasonicated again for 30 minutes. The mixture is washed in 10 ml ethanol 10% , 10 ml milliQwater, and 10 ml HCl 5 % and mixed for 20 minutes to repeat 3 times. Then, the results of MIPs is centrifugated to eliminate the solvent and is dried in oven for 1 night.The preparation of Molecularly Non Imprinted Polymers (MNIPs) is the same with preparation of MIPs but the different is without using template (Urea and creatinine). The result of MIPs that had been characterized with FT-IR, XRD and SEM.

The Characterization of Adsorption Ishotermal of MIPs

Amount of 0,01 gr MIPs is interacted into 5 ml urea and creatinine with concentration variation is 10^{-8}, 10^{-7}, 10^{-6}, 10^{-5}, 10^{-4}, 10^{-3} and 10^{-2} M and mixed for 30 minutes in constante temperature. The concentration of analit that had been adsorbed is measure the concentration of residue in solution. The measurement using spectrophotometer UV-Vis at λ = 278,5 nm for urea and 235 nm for creatinine.

RESULT AND DISCUSSION

Preparation of grahene Oxide and Graphene

Preparation of graphene oxide and graphene based on Hummers Method modified. The raw material for preparation of graphene oxide is graphite that oxided with $KmnO_4$ and the result is graphene oxide. Next, graphene oxide is reduced wih hydrazine and the result is graphene. Spectrum FTIR of graphite, graphene oxide and graphene show in picture 1.

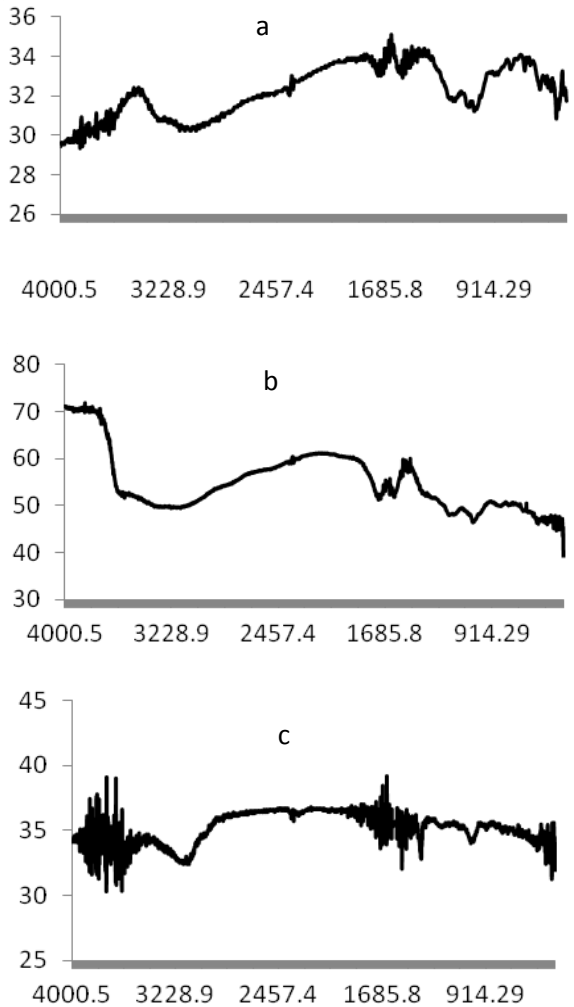

Figure 1. Spectrum IR (a) graphite, (b) graphene oxide, (c) graphene

The graphite has two peaks, 3400 cm^{-1} for –OH and 1640 cm^{-1} for –C=C- conjugation. The process of graphite oxidation became grahene oxide is showed at 1043 cm^{-1} (C-O/ epoxy group) and 1727 cm^{-1} (C=O bond). At peak 1043 cm^{-1} for C-O bond, 1628 cm^{-1} for C=C bond, 1727 cm^{-1} for C=O bond and 3400 cm^{-1} for -OH bond (Lie et al.2011a; liu et al. 2011b; Marcano et al. 2010). Graphene is the result of graphene oxide reduction using hydrazine. The sign of the graphene oxide become graphene is the lost of epoxy group, so at the graphene there is not peak at 1043 cm^{-1}.The picture 2 showed the morphology of graphite, graphene oxide and graphene. The graphite has morphology form like flake and more solid.

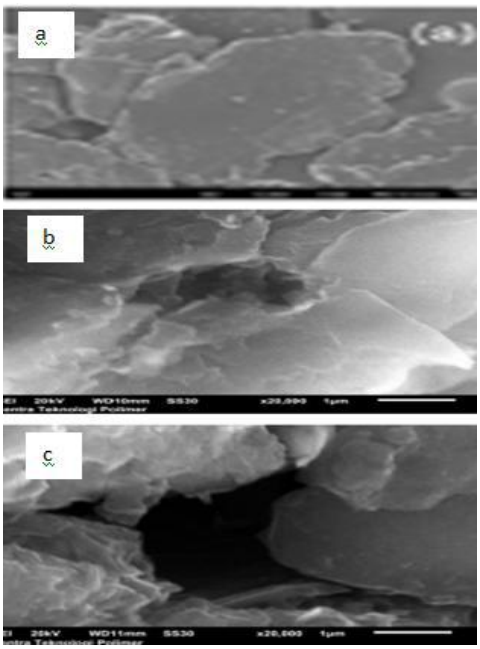

Figure 2. SEM of (a) Graphite, (b)Graphene oxide, (c). graphene

Graphene oxide is showed at picture 2b, the form of its morphology is thinner and transparant sheet. It's showed that graphite become graphene oxide. Picture 2c showed the graphene morphology is thinner and tranparant sheet than graphene oxide, but there is not monosheet because there is aggregation from graphene layer and it can be formed small cubic or recta angular shapes. The aggregation of layer was happened because the interaction Van der Walls betwen layer so the morphology of graphene is not smooth wholy. EDX analysis showed that graphene oxide and graphene is dominated carbon and oxygen as representation from C=C, C=O , OH, and epoxy group.

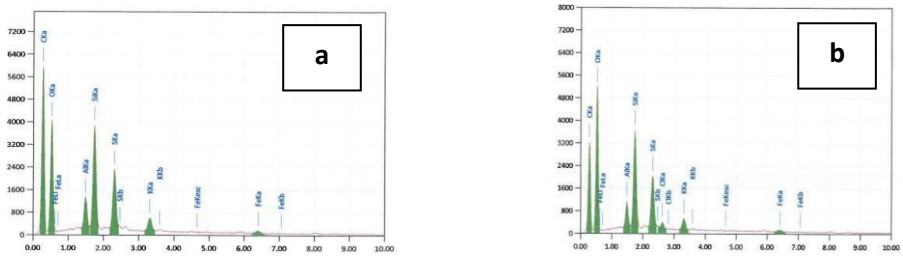

Figure 3. EDX of (a) graphene oxide (b) graphene

Picture 4 showed that the peak (002) of graphite is very sharp at 2θ 26,4866 and the peak (001) at 2θ 12,0433° is graphene oxide. Graphene Oxide is reduced to become graphene and there is new peak (002) at 2θ 26, 9985° that broad and intensity is low. 2θ position is appropriate graphene peak with margine 14° – 36°. This condition determined crystalinity is lower than graphite and graphene oxide. The schema reduction graphene oxide become graphene is showed at picture 5

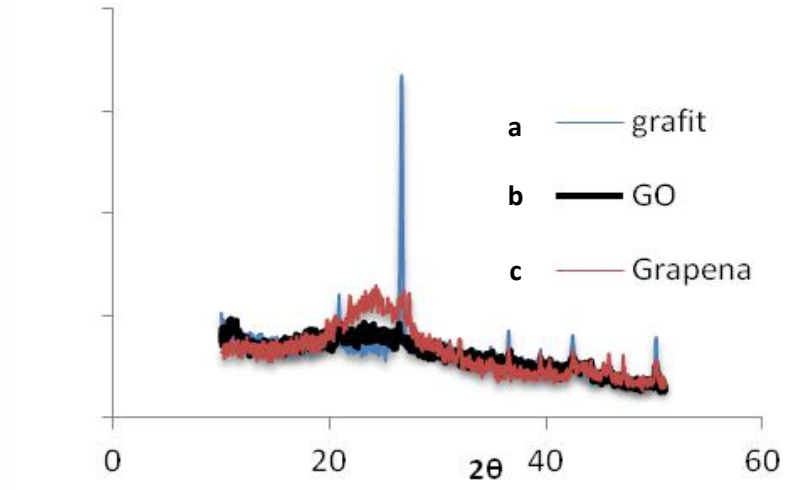

Figure 4. XRD of (a) graphite (b) graphene oxide (c) graphene

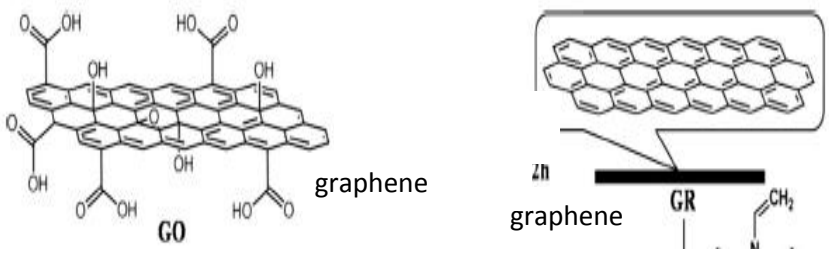

Figure 5. Reduction graphene oxide become graphene (Nikolina et al. 2013)

Preparation MIPs-dual template

The steps to make preparation of MIPs-dual template in this research is forming chitosan-graphene oxide composite and chitosan-graphene composite through dispertion mechanism into acetat acid. The result of the reasearch determined non covalent bonding from graphene oxide and graphene toward chain of chitosan polymer that produce the good dispertion mechanically and electrically.

The process of composite formed is added urea and creatinine simultanously. After that, urea and creatinine are washed into ethanol and the result is molecularly imprinted polymers-dual template. Scheme of the formed of chitosan-graphene oxide composite showed at picture 6

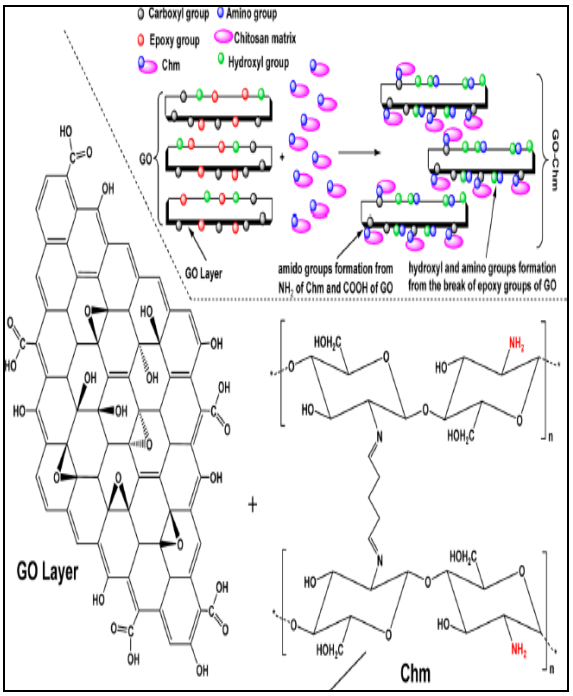

Figure 6. Scheme of chitosan-graphene oxide composite (Nikolina et al. 2013)

Picture 7a showed the spectrum FTIR of chitosan with -OH and –NH group at 3411 – 3248 cm^{-1}. Picture 7b showed the spectrun FTIR of MIPs-graphene at 1625 cm^{-1} (C=O vibration) and 1575 cm^{-1} (N-H bending). It is informed that graphene dispersed into chitosan and the composite had formed.

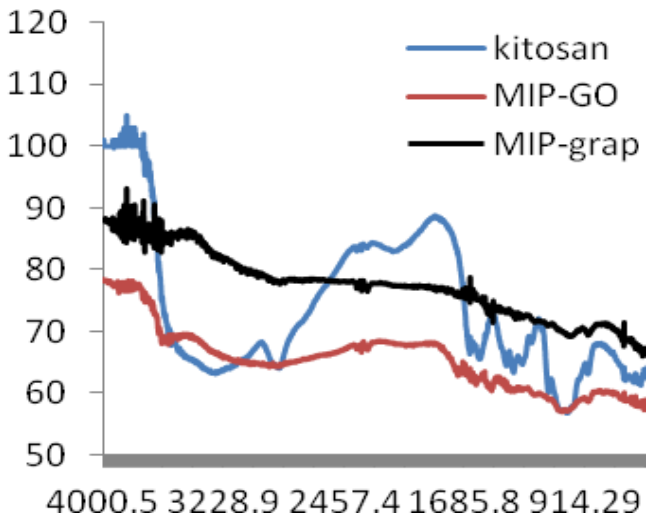

Figure 7. Spectrum of FTIR (a) chitosan, (b) MIPs-Graphene oxide, (c) MIPs-Grapehene

There is pore in the morphology of chitosan surface and there is no microstructure (picture 8a). Picture 8b and 8c showed graphene oxide and graphene are dispersed into chitosan surface uniformly and the formed of the pore based on urea dan creatinine template.

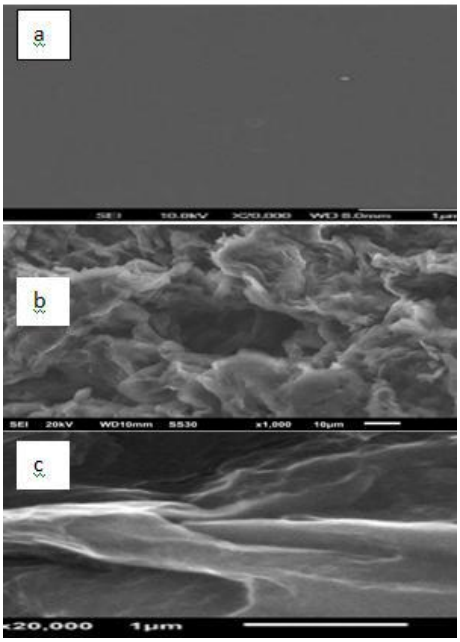

Figure 8. SEM of (a) Chitosan, (b) MIPs-graphene oxide, (c). MIPs-graphene

Picture 9 showed that the result MIPs is signed by posphore as the indication that there is cross linker (threepolyphospate) in the formed chitosan-graphene composite. Beside that, carbon and oxygen are very dominant as the indication that there is graphene and active group chitosan.

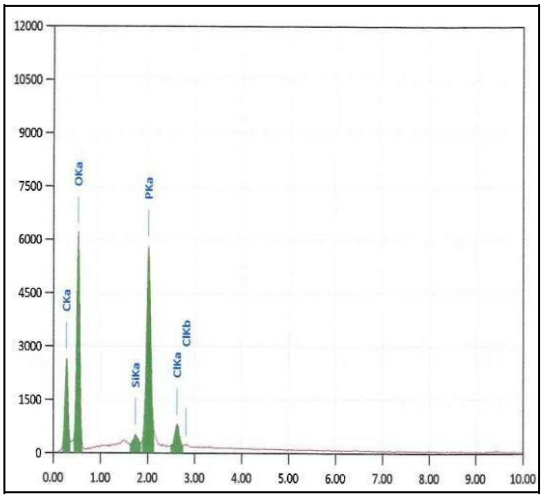

Figure 9. EDX Chart of MIPs-graphene

Picture 10 showed the broad peak (002) at 2θ 26,9985° had low intensity. It was happened because there is the other peaks based on chitosan, threepolyphospate, urea and creatinine. 2θ position is appropriate with graphene peak that the margine broad band is from 14° until 36°. It is determined that had been formed MIPs-grphene.

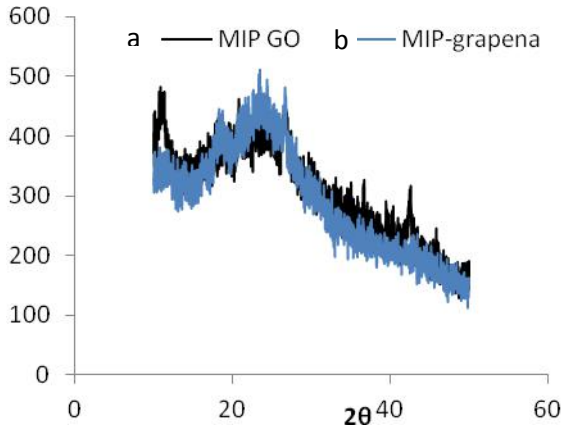

Figure 10. XRD of (a) MIPs-graphene oxide, (b) MIPs-graphene

The Characterization of Adsorption MIPs

a. The Effect of Concentration

The picture 11 and 12 showed that in adsorption process there is chemistry interaction among MIPs-graphene, urea and creatinine.

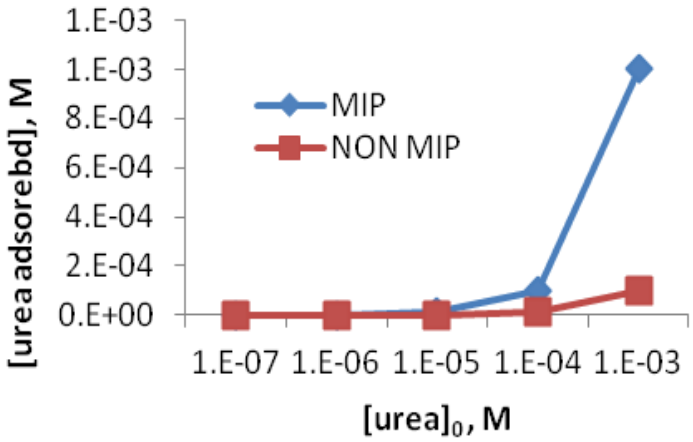

Figure 11. The effect of concentration in urea adsorption at MIPs-graphene

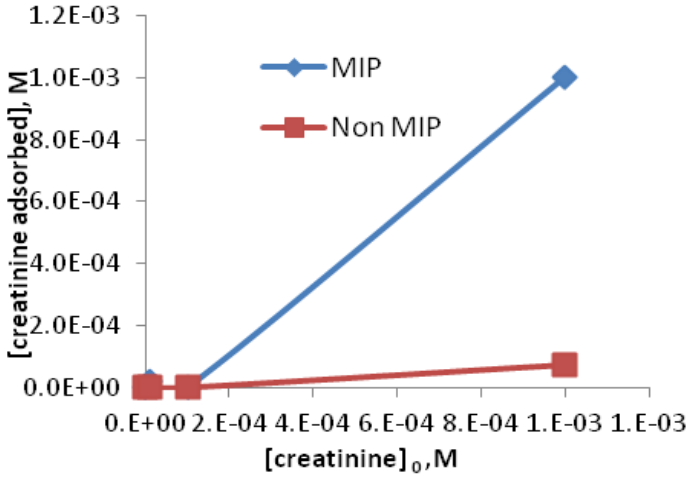

Figure 12. The effect of concentration in creatinine adsorption at MIPs-graphene

Urea and creatinine will be adsorbed by MIPs graphene and took place the pore of MIPs-graphene template through Hidrogen bonding mechanism betwen $–NH_2$ group at urea and creatinine and –OH group at MIPs-graphene. Urea and creatinine adsorption increased gradually and got saturated point.

b. The effect of time interaction

Picture 13 dan 14 showed that urea and creatinine concentration that had been adsorbed at MIPs graphene increased by increasing adsorption time and the concentration of urea and creatinin adsorption is constant in along time.

MIPs-graphene needed adsorption time for 30 minutes to make all of urea are bonding at active group MIPs – graphene and took adsorption balance at 30 minutes. There is no the increasing of urea adsorption significant at the increasing time automatically. It was happened because the active group of MIPs-graphene had reached saturated point by adsorbat.

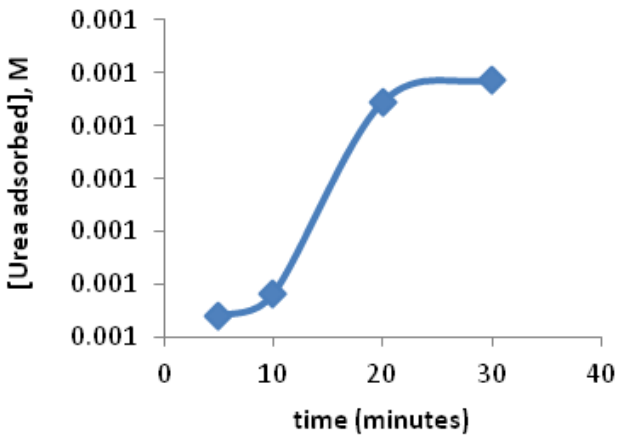

Figure 13. The effect of times in urea adsorption at MIPs-graphene

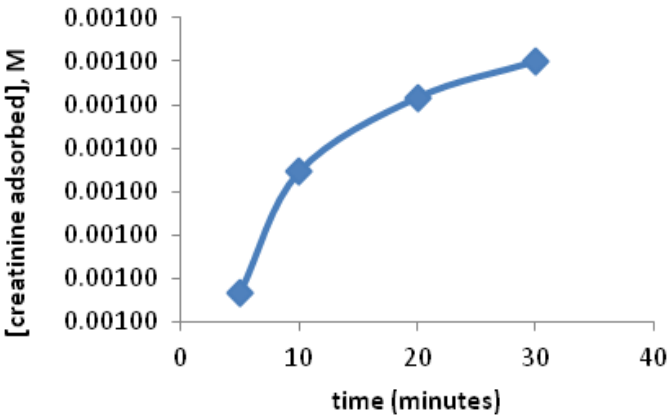

Figure 14. The effect of times in creatinine adsorption at MIPs-graphene

CONCLUSION

Molecularly Imprinted Polymers (MIPs) had been preparated using chitosan that dcomposited with graphene as its polymer, urea and creatinine as the templates. The result of MIPs can be used as adsorbent at urea and creatinin. The ability of adsorption MIPs to the urea and creatinin increased gradually by increasing concentration and time interaction by analite. The mechanism of MIPs adsorption to the urea and creatinine was happened through the mechanism of hydrogen bonding at the pore of MIPs template.

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SUPPLY CHAIN DESIGN OF CHILI COMMODITY TO IMPROVE THE NATIONAL FOOD SECURITY BY SYSTEM DYNAMICS SIMULATION

[1*)] Asep Ridwan, [1)] Ratna Ekawati, [1)] Muhammad Rifqi Nafiah

[1)] Industrial Engineering, Engineering Faculty, Sultan Ageng Tirtayasa University, Indonesia

[*)] Correspondence e-mail : asep.ridwan@untirta.ac.id

Abstract

Chili is one of vegetable commodities that have high economic value, because of its role to meet domestic needs, as an export commodity and food industries. This study begins with the identification of the basic model of supply chain and the problem in the chilli industry. Furthermore, the model is analyzed with system dynamics approach and simulation was done to know the behavior of the system in chili industry. The behavior of chili supply chain system will be increased until year 2025, but margin of the price will be increased too. Therefore, improvement scenarios are to decrease a margin value of the price along the chili supply chain. The government must determine the profit value for the chili supply chain. Also, the government must give an intervention for the price standard of marketing along chili supply chain so the price margin between farmer and the end customer will be decreased.

Keywords : chili, the price margin, system dynamics, supply chain, simulation

INTRODUCTION

Chili (Capsicum annuum L) is one of vegetable commodity which has high economic value because its role is big enough to fulfill domestic requirement as export commodity and food industry. Chili is a strategic horticultural commodity, both red chilli and cayenne pepper. Indonesian society is one of the biggest chili enthusiasts in the world. Therefore, chili becomes one of the important products of Indonesian food, even it can affect the rate of inflation.

Chili needs for large cities with a population of one million or more about 800,000 tons / year or 66,000 tons / month. In “hajatan” or religious festivals, chili needs usually increase in 10-20% of normal requirement. Chili productivity rate nationally during the last 5 years about 6 tons / ha. The urban community to meet the monthly needs is required chilli harvested area of about 11,000 ha/month, while in the celebration season of harvested area of chili that is available ranges of 12.100-13.3 ha / month. Also, the needs of chili for rural communities or small towns as well as for processed raw materials (Suwandi, et al.,2016). To meet all the needs of chili is needed supply of chili sufficient. If the supply of chili is less or lower than the demand so the price will increase. Conversely, if the supply of chilli exceeds the need, the price will decrease.

In terms of price, chilli has a characteristic often occur very high price fluctuations. For example, a surge in prices above 100% is very common. Even in January 1996 the price of chilli jumped about 327% compared to the previous month's price. Chili price increases to recur within 2-3 months and then thereafter decrease to 2-3 months. By using the Coefficient of Diversity (KK) as an indicator of stability, the price of chili in 2010 reached 57% and the price of red chili pepper in 2010 reached 35%, much higher than the price of rice and sugar in the region, at 6.6% and 3,7% (Farid and Subekti. 2012). Toward the end of the year until the beginning of the year, the price of chilli spikes high enough to reach more than Rp 100.000 / kg, while at a certain price can fall below Rp 10.000 / kg.

These seasonal price fluctuations occur almost every year. The spike in the price of chili is due to reduced supply, while constant and continuous demand every day, even increasing in certain seasons. Fluctuations in the price of chilli occur due to seasonal production of chili, rain factor, production cost and length of distribution channel (Farid and Subekti 2012). Meanwhile, the price

disparity between chilli regions occurred because the center of pepper production is concentrated on Java and the quality of road infrastructure is inadequate (Irawan 2007). The problem of national chili supplies availability is very important to be studied because it concerns national food security.

Food security is one of the decisive factors in the national stability of a country, both in economic, security, politics and social. Food security is a major program in agricultural development at present and in the future. Food security is the condition of the fulfillment of household food which is reflected from the availability of adequate food, both quantity and quality, safe, equitable, and affordable. Measures of food security in terms of self-sufficiency (independence) can be seen from the dependence of national food availability on food production in the country. The concept of self-sufficiency (independence) is scenario as a condition where national food requirement is at least 90% fulfilled from domestic production (Suryana, 2004).

Although food availability is sufficient at the national and regional levels, but if individual access to meet food needs is uneven so food security is still fragile. The aspect of the distribution of foodstuff to rural households that includes the function of place, space and time is also an effort to strengthen food security strategies so it is important to assess supply availability in chili pepper supply chain in the framework of national food security.

Several scientific studies related to this research have been conducted by several researchers. Sahara et al. (2011) examines the effect of quality farmer-chili merchant relationships of Indonesia on supply chains in modern and traditional markets. Hadi and Susetyo (2011) studied the marketing margin of red chili in Jember district. Prabhavathi et al. (2013) examines the supply chain analysis of red peppers in India comparing two types of supply chains. Kurniawan et al. (2014) examines the analysis and measurement of supply chain efficiency of large red chili commodities in Jember District. Ongirwalu et al. (2015) examines the downstream evaluation of the supply chain in the chili commodity logistics system in the traditional market of Pinasungkulan Manado. Tuti, K. et al. (2015) examines the design of a red chili commodity supply chain modeling model in West Java with a structured market orientation using case study method with qualitative modeling approach through identification of value stream mapping. Buntuan (2010) conducted a study on early simulation for food crisis management by using dynamic simulation method to see the parameters affecting food crisis then simulated with dynamic model. Akhmad (2013) conducted a study on food security with data analysis using a dynamic model on rice supply chain.

Supply chain is composed by a number of interacting entities through a distinct interaction pattern according to the structure formed. The more number of entities involved in the supply chain will affect the structure and determine the complexity of a supply chain. These entities interact to achieve a common goal, namely the final consumer. According to Zhou and Benton (2007), a supply chain is an integrated system. As a system, the point of view of the analysis of the supply chain must be comprehensive. The entire system components must be viewed as an integral whole. Inequality in one component will disrupt the system as a whole. Therefore, the purpose of a study or analysis of a supply chain is a proportionate increase overall across entities from upstream to downstream.

This research was conducted to identify the basic system of chili pepper supply chain in achieving national food security, to formulate conceptual system and formulation of chili supply chain model to achieve national food security, and to know the behavior of chili supply chain system for the next 10 years.

RESEARCH METHOD

The design of dynamic system of chili supply chain starts from the analysis of the situation and condition of chili industry in Indonesia, then identifies the basic system of chili supply chain by looking at upstream and downstream sub-system diagrams and causal loop diagram of chili supply chain. Flow diagrams with mathematical equations, simulations and validation tests into supply chain models with economic and social aspects as policy analysis or decision. This research is a combination of

explanatory research and causal research that is combination of secondary data analysis and experiment. Exploratory research with secondary data analysis to know the situation and problem of national chili, while causal research with experiment to know the relationship between phenomenon in model.

Data Retrieval

Data onto this research are primary and secondary data. Primary data obtained from the observation and direct interviews for the relevant sources include several farmer groups, merchant, and chili consumers, while secondary data obtained from relevant agencies include the Central Bureau of Statistics, the Department of Trade and the Department of Agriculture.

Solution to problem

Problem solving plot is a general step done in doing research. The problem solving flow is useful for providing information on the beginning of the research to the completion of the research. The following is a problem solving plot as an overview of the research undertaken. Flow chart of research framework can be seen in Figure 1:

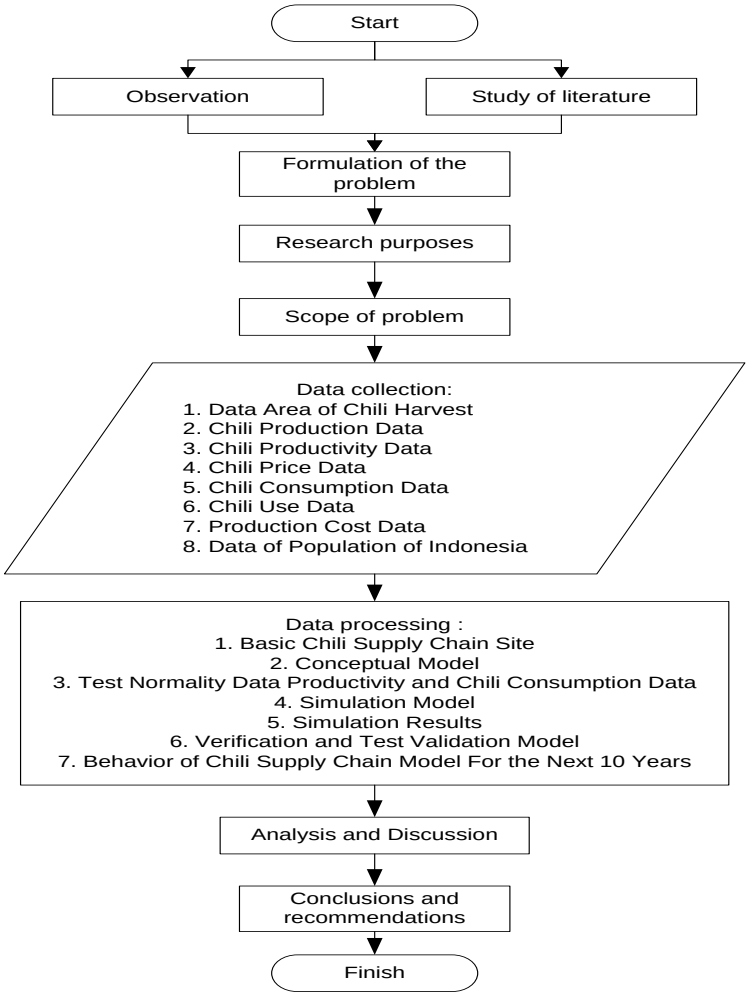

Figure 1. Flow Chart of Research Framework

RESULTS AND DISCUSSION

Basic Chain Supply Chain System

Supply chain as a system can not be separated from the close relationship between components, as well as the supply chain system on horticultural commodities such as chili. Chili availability system is divided into three sub-systems namely sub-system production (manufacturer), sub-system distribution (supplier), and sub-system consumption (consumer). All three of these interconnected systems form a chili supply chain system (Figure 2). The components of the supply chain in more detail as shown in Figure 2.

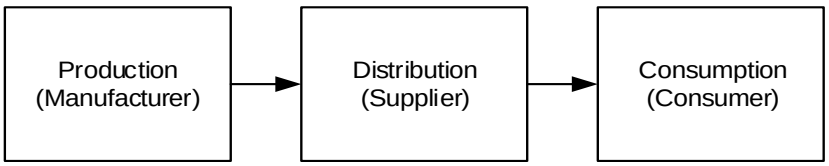

Figure 2. Mapping of Chili Supply Chain Subsystem Elements

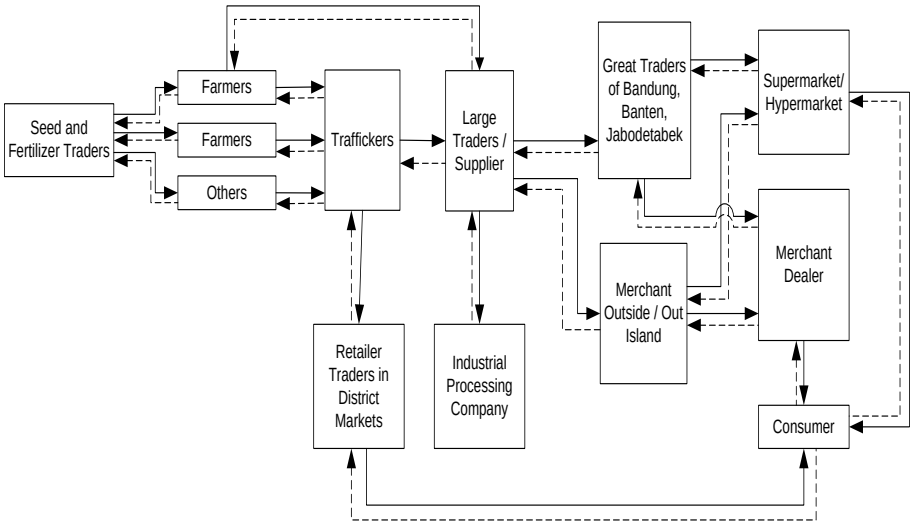

Figure 2. Supply Chain Components in Indonesia

The distribution and marketing system covered by the chili supply chain vary by region of production and market objectives. Chili supply chain is still largely targeted to meet the local, provincial and provincial markets for example: Jakarta, Bogor, Depok, Tangerang, Bekasi (Jabodetabek) markets, Banten markets and Bandung markets. The traders involved in the distribution of chilli are traders, wholesalers or wholesalers including suppliers of processing industries, and retailers, both traditional market retailers and modern markets (supermarkets, hypermarkets and supermarkets).

Collecting traders acts as collectors and buyers of pepper production from farmers. Wholesalers, in addition to acting as buyers of the products of collecting traders and farmers, often also play the role of capital providers (informal finance institutions) for the farmers and collecting traders who are their accomplices. Capital loans to farmers can be in the form of money or nature (seeds, fertilizers, and medicines).

In the supply chain institutional, farmers act as chilli producers, which is responsible for the production process of chili. Collecting traders act as collectors and buyers of pepper production from

farmers. Wholesalers act as buyers of the products of collecting merchants and capital providers for the farmers and collecting traders who are their subordinates. Inter-island traders play a role in distributing inter-regional chilli commodities, these actors usually have transport fleets, especially trucks and pickup trucks. Market retailers play a direct selling role to consumers in traditional markets and modern markets (Supermarkets, Hypermarkets and Supermarkets) that sell chillies to consumers directly in central consumption areas.

In addition to knowing the supply chain chili pepper, another thing that is not less important is the marketing margin of chili on every component of the supply chain. The result of Hadi and Susetyo (2011) research on marketing margin analysis of red pepper in Jember District shows that during planting season I and II in 2011 amounted to IDR 37.250/ Kg. This margin is above the price of red pepper at the producer level of only IDR 20,750/kg. Indeed, between the margin value should be much smaller than the price at the producer level. The margin value consists of Share price received by farmers amounting to 35.78% of the price paid by the end consumer and amounted to 64.22% is the share of marketing margin. The total marketing margin of 27.40% is the marketing cost incurred by the four marketing agencies involved and then 36.82% is the advantage of the four marketing agencies involved.

The description of the injustice of marketing share of red chilli in as indicated above indicates that the marketing process of chili has excess demand or undersupply chilli products. Therefore, the government tries to intervene in the market through imported chili actions from India, China and Vietnam. Nevertheless, the price of the product has not been any signs of decline even tends to increase until close to IDR 100.000/kg and even outside the region can reach above IDR 100.000/kg to IDR 150.000/kg. What a very irrational price. This means that the price of red chili is high at the consumer level and very low at the farm level, so the high price is only enjoyed by the traders involved in the marketing process.

If the price of the sky is higher than the value of its marketing margin, it may still be accepted by economic logic. Viewed from the profit ratio aspect that the highest average ratio experienced by retailers and the lowest received by traders between regions (districts). This means that the level of fairness in receiving profits is very unfair compared to the proportion of costs incurred by each marketing agency. Supposedly the highest ratio experienced by traders between regions / districts with the highest marketing expenditure of each product Kg, not by retailers whose marketing costs on average only IDR 838 / kg. Symptoms of the high price of red chili due to bad weather so that production plummeted that led to a limited supply. However, the government has taken import actions from India, China, and Vietnam, but product prices remain expensive.

Conceptual Model Supply Chain of Chilli

1. Problem Definition

The dynamic model illustrates the interactions between elements that make up the chili supply chain system. The problem of chilli availability is a fairly complex system problem involving various components, variables in which interact and integrated. The availability of chili nationally can be viewed as a system dynamics problem that changes over time and is influenced by factors that are also dynamic. The purpose of modeling the availability of chili is to look at the pattern of chili availability in the future to improve national food security with a variety of scenario development alternatives that are in line with real conditions.

The developed system dynamics model is limited to matters relating to the supply, supply and demand of chili. This model is made based on the identification of problems poured into the causal loop, formulated in stock and flow diagrams and simulated using Powersim software.

2. Identification of Key Variable

In determining the level of national chili availability, researchers need to know the factors that affect the supply of chili. Based on the observation and literature study it is known that the national chilli availability level is the difference between the production and consumption of chili. Chili

production is influenced by variables such as planting area, productivity, farmer household income, cultivated area, conversion of land, conversion and extensification of cultivated area. Constants are required as inputs to the model in addition to these variables, making it easier to modify the model in case of changes in accordance with the actual conditions. These constants include the percentage of additional planting costs, the area of planting area (extensification) per year, and the percentage of land conversion (conversion) per year.

Chili consumption is influenced by variables such as chili production, household consumption, industrial consumption, aging for seeds and scattered. Chili consumption is strongly influenced by people's behavior in consuming chili. Level of pepper needs can be seen from the dynamics of population development that is very influential on the demand for chili for consumption. The dynamics of this population model will produce output in the form of future population forecasts. The dynamics of population development are formed through the interaction between the variables of the population of Indonesia with the variable rate of population growth and the rate of death of the population that form a relationship. The greater the rate of population growth per year the greater the annual population, the greater the rate of death of the population, the less the annual population. The consumption pattern is based on population dynamics and the average requirement of chili for consumption is converted in kg/capita/year. Required variable (constant) level of chilli consumption which input average chili consumption in accordance with real conditions to know the consumption needs of chili. Chili consumption level variables will further impact the positive effect on the amount of chili consumption. The greater the level of chili consumption per capita, the greater the amount of chili needed for consumption.

In addition, the relationship between production and consumption of chili will affect the supply chain dynamics. In terms of supply or distribution there is a supply chain component which is described by several variables such as producer price, collectors, small traders, wholesalers, retailers, consumer prices, and income from RTs. The relationships among these variables will simulate how the effect of price changes on the producer level on prices in each other supply chain components.

3. Reference Model

Reference models related to the design of the chain's dynamic supply chain model or the agricultural commodity supply chain model, Akhmad Mahbubi et.al (2013), entitled "The Dynamic Model of Sustainable Rice Supply Chain in National Food Security Efforts".

4. Development of Causal Loop Diagram

Causal simulation model is the basis of making the main model simulation. Causal simulation model is built based on the relationship between variables in the model (Japar et al., 2013) The Causal Loop Diagram relation explains the causal relationship between variables with each other. The relationships between these variables form a long chain of causal loops that will provide feedback on other variables. Causal Loop diagram explains about the causal relationship of supply availability level of chili influenced by the level of production, distribution (supply) and level of consumption.

Causal Loop The diagram above illustrates the relationship between production, distribution and consumption of chili. A causal relationship with a positive sign (+) indicates if the dependent variable increases then the independent variable will increase. Similarly, the causal relationship with the negative sign (-) indicates if the dependent variable increases then the independent variable will decrease.

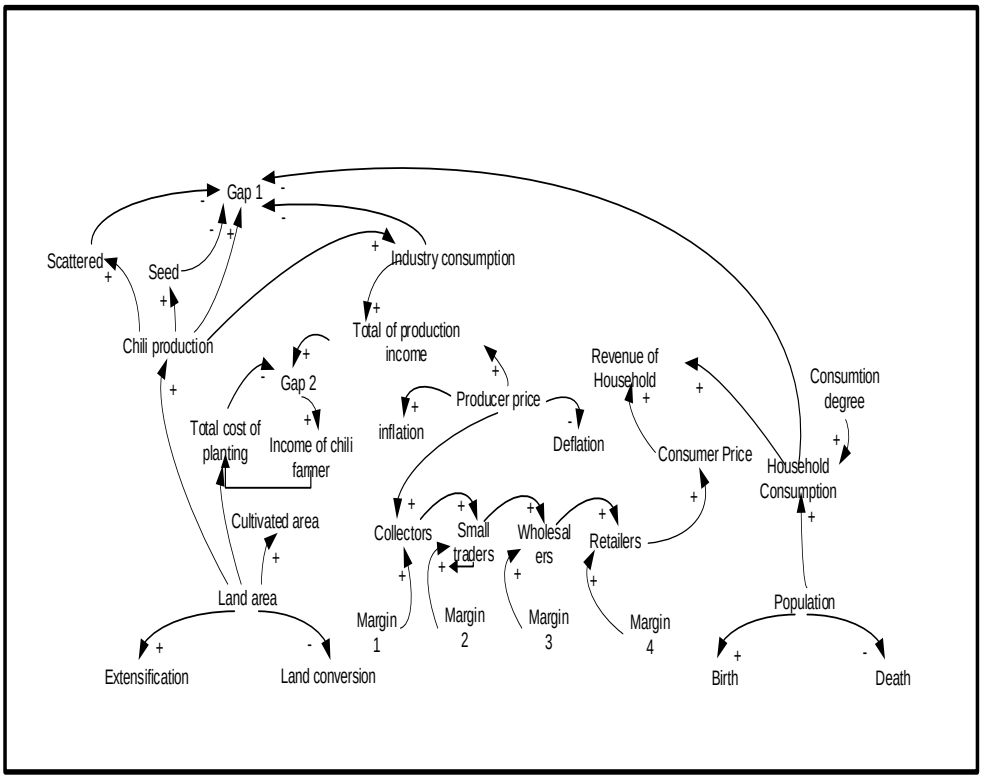

Figure 3. Causal Loop Diagram of Chili's supply chain in Indonesia

Test Data Normality

Normality test is a test of data to see whether the residual value is normally distributed or not (Ghozali, 2011). Normally distributed data will minimize the likelihood of bias occurring. In this study, to know the normal distribution of data using Kolmogorov-Smirnov Test manual calculation. This data distribution is required for equation on Stock Flow Diagram.

The following is the distribution of average productivity data of chilli ton / ha in 2006-2015 with manual calculation :

Formulation of hypotheses :

H0: μ = μ0 means the sample data comes from the normal distribution

H1: μ ≠ μ0 means the sample data does not come from the normal distribution

Significansi α = 0,05

Calculation of the area of the curve z : $Z = \frac{X - \bar{x}}{S}$ ..... (1)

Test Statistic : $D = \left| F_n(x) - F_0(x) \right|$ ..... (2)

Critical area : Reject H_1 if $D < D_\alpha$

Accept H_1 if $D > D_\alpha$

Table 1. Calculation of Normal Distribution of Chili Productivity

Thn	X	Freq	Cumul	$F_n(x)$	Z	F(x)	D
2006	5.796	1	1	0.100	-0.65	0.0985	0.0015
2007	5.525	1	2	0.200	-1.01	0.0869	0.1131
2008	5.452	1	3	0.300	-1.11	0.0778	0.2222
2009	5.854	1	4	0.400	-0.57	0.2776	0.1224
2010	5.617	1	5	0.500	-0.89	0.6808	0.1808
2011	6.199	1	6	0.600	-0.11	0.516	0.0840
2012	6.838	1	7	0.700	0.75	0.5948	0.1052
2013	6.905	1	8	0.800	0.84	0.5557	0.2443
2014	7.101	1	9	0.900	1.11	0.6772	0.2228
2015	7.496	1	10	1.000	1.64	0.6293	0.3707
Rata-rata	6.278						
St. Deviasi (s)	0.743						

D is the calculated value kolmogorov smirnov one sample.

Dα is the critical value for one sample kolmogorov smirnov test, obtained from kolmogorov smirnov table one sample.

$F_n(x)$ Is the cumulative opportunity value derived from the comparison of the data by the number of whole data.

$F_0(x)$ Is the cumulative opportunity value obtained from the z curve

Example Calculation:

$Z = \frac{X-\bar{x}}{S} = \frac{5.796-6.278}{0.743} = -0.65$

$F_0(x)$ ketika Z = -0.65 adalah 0.0985

$F_n(x) = \frac{1}{10} = 0{,}1$

$D = \left|F_n(x) - F_0(x)\right| = |0{,}1 - 0{,}0985| = 0{,}0015$

$D_\alpha = 0{,}371$

From the calculation, it can be seen that D count has a value of 0.371, while D table has a value of 0.409. Therefore, D <Dα = 0.371 <0.409. This means that H1 is rejected, so the existing sample data comes from the normal distribution.

Based on the result of manual calculation with excel software, it can be seen that productivity data of chilli is normal distribution. Therefore, for chili production formula can use Normal function by involving chili productivity mean and standard of chili productivity deviation on Stock Flow Diagram. Similarly, the consumption level of chili kg / capita / yr was tested for normality and the results were normally distributed.

5. Development of Stock Flow Diagram

Based on the result of causal loop diagram which has been designed before, hence can be done development of stock flow diagram of dynamic model of chili supply chain in Indonesia. In the stock flow diagrams that have been made to explain the grooves get the value of gap 1 between the level of production and consumption levels that indicate the availability of chili in aggregate every year

that fulfillment is done without import. In addition to this model there is a gap 2 that shows the difference between the production income and the cost of planting chili as well as showing the change in price of chili pepper from each component in chili supply chain. The following is a stock flow diagram of Chain Supply Chain in Indonesia :

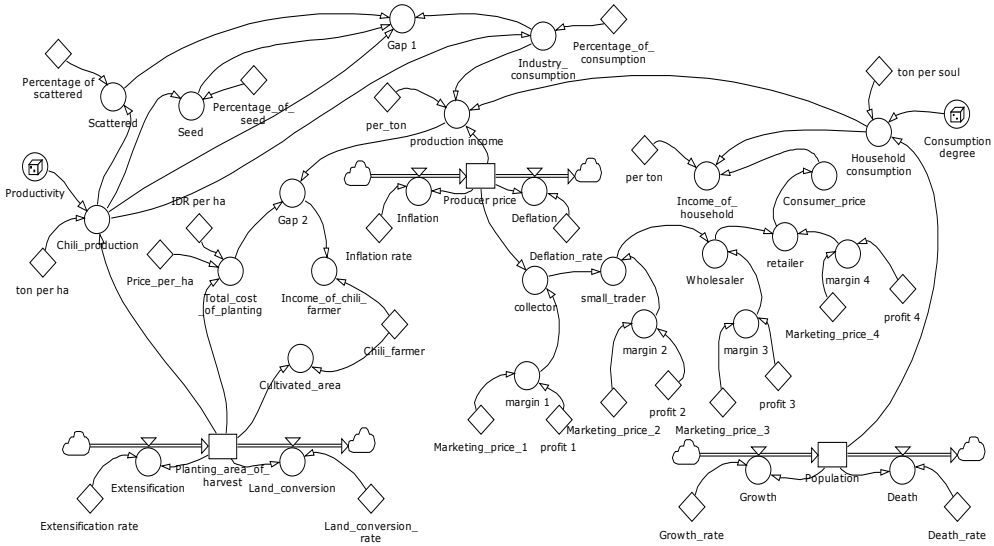

Figure 4. Stock Flow Diagram Chili supply chain in Indonesia

6. Simulation Results

The simulation result of the system shows the value generated from the calculation by using Powersim 10. The dynamic model of chili pepper supply chain in Indonesia will be shown simulation results from three sub chains of supply chain of chili, namely production sub-system (harvested area, pepper production and farmer income), sub Distribution systems (supply chain dynamics) and consumption sub-systems (RT and Industry consumption). The number of periods in exsisting system simulations is 10 years from 2006-2015. The following is the result of calculation of harvested area, chili production, producer price and consumption level of chili :

Table 2. Calculation Result of Dynamic Model Chain Supply Chain Model

Year	Harvested area (ha)	Chili production (ton)	Producer price (IDR)	Consumtion degree (IDR/capita/year)
2006	204,747.00	1,321,016.60	10,906.61	2.98
2007	210,560.70	1,024,557.77	11,874.09	3.22
2008	216,539.48	1,317,066.09	12,927.40	2.74
2009	222,688.03	1,296,559.57	14,074.14	3.13
2010	229,011.16	1,333,067.44	15,322.60	3.22
2011	235,513.83	1,423,697.33	16,681.81	3.35
2012	242,201.14	1,495,542.46	18,161.59	3.14
2013	249,078.34	1,518,698.54	19,772.63	3.08
2014	256,150.81	1,864,936.81	21,526.59	3.00
2015	263,424.10	1,866,774.53		2.93

From the simulation result shows that harvest area, chilli production, producer price and chilli consumption level tend to increase every year. This indicates that chili is one of the commodities that Indonesians are interested in and have good prospects for the future. Here is a graph of the existing simulation results.

Verification and Validation Model

At this stage validation test of the simulation results have been done to determine whether the different models significantly or not with the real system. Validation in dynamic system modeling can be done in several ways including direct structure tests without model processing, structural behavior test model (model oriented behavior test) with model process, and comparison of model behavior with real system or quantitative behavior pattern comparison (Daalen and Thissen, 2001), i.e. by the test of the mean absolute percentage error is one of the relative measures involving percentage errors. This test can be used to determine the suitability of forecasted data data with actual data.

$$MAPE = \frac{1}{n} \sum \frac{[Xm - Xd]}{Xd} \times 100\%$$

Description :
Xm = Data of simulation result
Xd = Data actual
N = Period / number of data

Criteria for model accuracy with MAPE test (Lomauro and Bakshi, 1985 in Soemantri, 2005) is:
MAPE < 5% : Very Precise
5% < MAPE < 10% : Precise
MAPE > 10% : Not Precise

Here is a table of validation calculation of harvested area, chili production, producer price and chili consumption level on actual / actual system with simulation result :

Table 3. Validation of Exsisting and Actual Results of Planting of Chili

Year	Simulation (Xm)	Actual (Xd)	[Xm-Xd]	[Xm-Xd]/Xd	Percentage (%)
2006	204,747.00	204,747.00	0.00	0.00	0.00
2007	210,560.70	204,048.00	6,512.70	0.03	3.19
2008	216,539.48	211,566.00	4,973.48	0.02	2.35
2009	222,688.03	233,904.00	11,215.97	0.05	4.80
2010	229,011.16	237,105.00	8,093.84	0.03	3.41
2011	235,513.83	239,770.00	4,256.17	0.02	1.78
2012	242,201.14	242,366.00	164.86	0.00	0.07
2013	249,078.34	249,232.00	153.66	0.00	0.06
2014	256,150.81	263,616.00	7,465.19	0.03	2.83
2015	263,424.10	255,716.00	7,708.10	0.03	3.01
				Σ	**21.50**
				MAPE	**2.15**

Example Calculation:

[Xm-Xd] = $[263424 - 255716]$= 7708.10

$$\frac{[Xm-Xd]}{Xd} = \frac{7708.10}{255716} = 0.03$$

Percent % = 0.03 x 100%
= 3 %

$$MAPE = \frac{1}{n}\sum \frac{[Xm - Xd]}{Xd} \times 100\%$$

$$= \frac{1}{10} \text{ x } 21.50 \text{ x } 100\% = 2.15\ \%$$

From result of calculation of validation test known that MAPE for planting area is 2.15%. Based on the criteria of model accuracy with MAPE test, it is found that MAPE planting area of chili <5% means that the model is very precise or very describes the real condition (valid). Other validation results can be seen in table 4:

Table 4. Existing and Actual Simulation validation results

No.	Validation item	MAPE (%)	Conclusion
1	Produksi cabai	7.00	Model tepat (valid)
2	Produsen cabai	5.83	Model tepat (valid)
3	Konsumsi cabai	6.17	Model tepat (valid)

Behavior of Chilli Supply Chain System for the Next 10 Years

Modeling the dynamics of chili availability system, model design, simulation and analysis is done by referring to the objectives and scenarios in each model. Some policy scenarios to be used in behavioral analysis. The chili supply chain system for the next 10 years is as follows :

Scenarios without Policy Change

This scenario is assumed as a simulation result without any policy changes such as government intervention to see system behavior over the next 10 years and determine the point of improvement whether in the production sub-sub-system, consumption sub-system or distribution sub-system (supplier).

1. Sub System Production

The production sub-system is related to matters affecting the production of chili, ie planting or harvest area, production, cultivated area and household income of chili farmers. Below is a projection result on chilli production sub system for 10 years ahead.

From the simulation result, the value of chili harvest area and cultivated area increase every year, while chilli production fluctuated or fluctuated during the next 10 years. The highest production occurred in 2024, which was 2,356,992 tons and the lowest was 2014 at 1,451,654 tons. Fluctuations in chili production is due to changes in the productivity of chili due to climate and crop failure due to pests or other natural factors. In terms of income RT chili farmers value increases every year where in 2025 income of RT chili farmers with an area of 0.1 ha of land is IDR 47,007,430 per year. This indicates that there will be an increase in the welfare of chili farmers and show the prospect of better chili farming business.

Table 5. Results of Projection Simulation on Chilli Production Sub-System Year 2016 - 2025

Year	Harvested area (Ha)	Production (Ton)	Wide arable (Ha per HH farmers)	Revenue HH farmers (IDR/Year)
2016	270,904	1,451,654	0.17	19,640,038
2017	278,596	2,202,969	0.17	25,899,711
2018	286,507	1,682,557	0.17	25,881,278
2019	294,642	1,935,561	0.18	27,130,671
2020	303,008	2,107,352	0.18	33,176,116
2021	311,612	2,256,178	0.19	37,067,854
2022	320,460	1,898,228	0.20	35,908,167
2023	329,559	2,257,579	0.20	44,635,923
2024	338,917	2,356,992	0.21	47,350,626
2025	348,540	2,002,323	0.21	47,007,430

(Note: HH= house hold)

2. Sub System Consumtion

The consumption sub-system is related to the things that affect the consumption of chilli, ie consumption of RT, industrial consumption, scattered and seeds. Here is a of projection result on chili consumption sub system for 10 years ahead.

Table 6. Results of Projection Simulation on Chilli Consumption Sub-System Year 2016 - 2025

Year	Utilization(Ton)			
	HH Consumption	Industry consumption	scattered	Bibit
2016	828,371	435,496	76,647	10,452
2017	869,852	660,891	116,317	15,861
2018	900,266	504,767	88,839	12,114
2019	772,176	580,668	102,198	13,936
2020	887,218	632,206	111,268	15,173
2021	882,449	676,853	119,126	16,244
2022	817,998	569,468	100,226	13,667
2023	906,825	677,274	119,200	16,255
2024	836,414	707,097	124,449	16,970
2025	806,787	600,697	105,723	14,417

Note: HH =household

From the simulation results obtained the value of the use of chili for the consumption of RT, scattered and the seeds of the value tends to be stable for the next 10 years for the highest RT consumption occurred in 2023 of 906.825 tons and the lowest in 2019 of 772.176 tons, while for industrial consumption fluctuated with the trend increases every year.

3. Comparison of Chili Production and Consumption

Based on the simulation results show that the production rate of chilli is greater than the total use of chili in Indonesia. The following is the result of projected comparison of production and use of chili for the next 10 years.

Table 7. Results of Production and Chili Use Projection Simulation Year 2016 - 2025

Year	Production (Ton)	Utilization(Ton)				
		Consumption HH	Industry Consumption	Scattered	Seed	Total
2016	1,451,654	828,371	435,496	76,647	10,452	1,350,966
2017	2,202,969	869,852	660,891	116,317	15,861	1,662,921
2018	1,682,557	900,266	504,767	88,839	12,114	1,505,987
2019	1,935,561	772,176	580,668	102,198	13,936	1,468,978
2020	2,107,352	887,218	632,206	111,268	15,173	1,645,865
2021	2,256,178	882,449	676,853	119,126	16,244	1,694,673
2022	1,898,228	817,998	569,468	100,226	13,667	1,501,360
2023	2,257,579	906,825	677,274	119,200	16,255	1,719,554
2024	2,356,992	836,414	707,097	124,449	16,970	1,684,931
2025	2,002,323	806,787	600,697	105,723	14,417	1,527,623

The simulation results of the production and use of chili using powersim software show the value that varies from year to year. Overall the production of chilli is always above the total use of chili so it can be said that during the next 10 years there will be no shortage of pepper stock and food security for chili commodity is reached and if managed properly then the government does not need to import chili. Therefore, the government must maintain stability in the sub-system of production and consumption sub-system.

4. Sub System Distribution (Supply)

The distribution sub-system deals with matters affecting the distribution of chilies from producers to consumers. In the sub-distribution system the components involved consist of producers / chili farmers, collectors / wholesalers, small traders, wholesalers, and retailers. The focus of this sub-system on supply chain is the price margin from upstream to downstream of chili pepper supply chain.

From the simulation result, the price of chilli turns up from year to year both side of producer and consumer. However, the price margin between producer price and consumer price is also higher. If left then it will cause harm both side of the manufacturer and the consumer side. Here is a table and graph of simulation results in chilli distribution sub-system for the next 10 years.

To see the price differences in each component of the chili supply chain the following table 9 and price comparison charts on the chili supply chain components are presented.

Table 8. Projected Simulation Results Average Chili Price Year 2016 - 2025

Year	Harga Cabai (IDR/Kg)		Price margin (IDR/Kg)
	Produsen (farmer)	Consumer	
2016	25,515	71,321	45,805
2017	27,778	77,647	49,869
2018	30,243	84,535	54,292
2019	32,925	92,034	59,108
2020	35,846	100,198	64,352
2021	39,026	109,086	70,060
2022	42,487	118,762	76,275
2023	46,256	129,297	83,041
2024	50,360	140,767	90,407
2025	54,827	153,254	98,427

Table 9. Price Comparison Simulation Results on Chili Supply Chain Components in Indonesia 2016-2025

Year	Chili Price (IDR/Kg)				
	Producers (farmers)	Collectors	Small traders	wholesalers	retailers
2016	25,515	38,426	53,796	64,555	71,321
2017	27,778	41,834	58,568	70,282	77,647
2018	30,243	45,545	63,763	76,516	84,535
2019	32,925	49,585	69,420	83,303	92,034
2020	35,846	53,984	75,577	90,693	100,198
2021	39,026	58,773	82,282	98,738	109,086
2022	42,487	63,986	89,581	107,497	118,762
2023	46,256	69,662	97,527	117,032	129,297
2024	50,360	75,841	106,178	127,414	140,767
2025	54,827	82,569	115,597	138,716	153,254

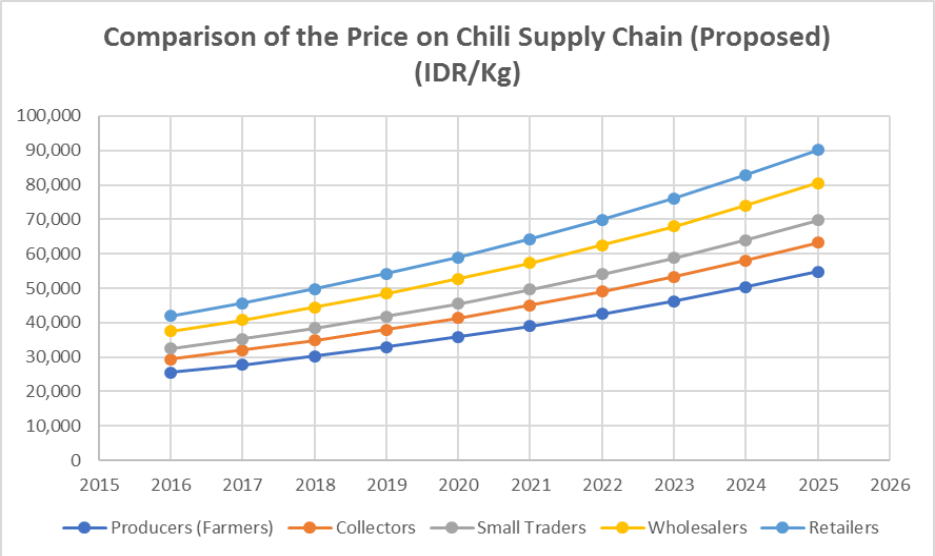

Figure 5. Projection Graph of Price Comparison on Chili Supply Chain

From the simulation results, it can be seen that the problem of chilli supply in Indonesia is found in supply chain sub-sector, that is price margin between producer and consumer price every year will increase or widen as shown in figure 8. Therefore, improvement scenario made to reduce margin price in every component of chili supply chain.

Marketing Margin Decrease Scenario on Supply Chain Components

The decreasing scenario of marketing margin in chili supply chain is done as an effort to minimize marketing margin between components in chili supply chain. Margin marketing is the difference between the purchase price and the selling price, the value of this margin is composed of components of marketing costs and profit per kg. Marketing costs are composed of transportation costs, packaging costs and storage costs.

In the calculation of the marketing margin value, it is assumed that for the collecting volume category, the purchase of chili from farmers is 3000 Kg / Month, small traders 60,000 Kg / Month, wholesalers 600,000 Kg / Month and retailers 150 Kg / Month. And the county is to meet the local needs of large traders with a percentage of 65% for the market within the province and 35% for markets outside the province. The following is the basis for determining the decrease of price margin on chili pepper supply chain. Table 10 contains the value change of the percentage of profit and marketing costs of existing and proposed.

Table 10. Percentage of Marketing Price and Profit for Existing and Proposed

	Existing		Proposed	
	% Marketing price	% Profit	% Marketing price	% Profit
Collectors	13.76	36.84	5.58	10.0%
Small Traders	18.24	21.76	5.23	5.0%
Wholesaler	14.86	5.14	13.17	2.5%
Retailers	1.6	8.88	1.90	10.0%

Simulation results of the decreasing of marketing margin on chili supply chain component can be seen in Table 11 and Figure 7 for the next 10 years.

Table 11. Results of Price Comparison Simulation on Chili Supply Chain Components Proposed in Indonesia Year 2016 - 2025

Year	Chili Price (IDR/Kg)				
	Producers (Farmers)	Collectors	Small Traders	Wholesalers	Retailers
2016	25,515	29,414	32,423	37,503	41,966
2017	27,778	32,023	35,299	40,830	45,689
2018	30,243	34,864	38,430	44,452	49,742
2019	32,925	37,956	41,839	48,395	54,154
2020	35,846	41,323	45,550	52,688	58,958
2021	39,026	44,989	49,591	57,362	64,188
2022	42,487	48,980	53,990	62,450	69,882
2023	46,256	53,324	58,779	67,990	76,081
2024	50,360	58,054	63,993	74,021	82,830
2025	54,827	63,204	69,670	80,587	90,177

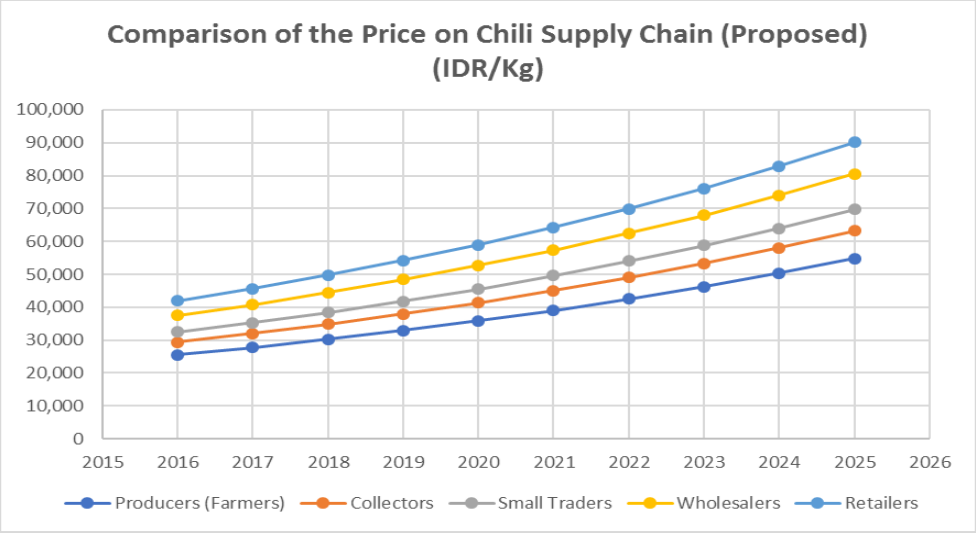

Figure 6. Projected Graph of the Price of Chain of Supply Chain of Supply Chain

From the simulation results obtained margin marketing is smaller and evenly distributed along the chili supply chain components. The price margin between producer and consumer is still relatively high, this is because supply chain is not efficient yet and further study on marketing cost calculation on each component involved in chili supply chain system must be done.

CONCLUSION

The dynamic system model of chili supply chain is appropriate and acceptable so that the result of this research can be summarized as follows. **First**, the national chili system consists of several subsystems, including distribution or supply, production, and consumption. Each subsystem consists of elements or elements that are more specific and influenced by the development of time so that the national neglect system is dynamic. The national neglect system is cross-sectoral because it encompasses various related institutions, such as chili consumption subsystem related to population problem, whereas production subsystem is related to land area and agriculture cultivation. **Second**, the result of chili production subsystem is influenced by variables such as planting area, conversion of land, conversion, extensification, productivity and income of chili farmers. The distribution subsystem, the supply of chili depends on the price margin on the chili supply chain components composed of components of marketing and profit costs. Chili consumption is influenced by the behavior of people in consuming chillies on the consumption subsystem. Submodel consumption needs can be seen dynamics of the development of the population that is very influential on the demand for chili for consumption. **Third**, the result of scenario without policy change then chili food security will be sustainable with the value of production above the level of use of chili so that for the next 10 years food security for chili is still safe. However, the value of the price margin is higher so the improvement scenario is done to minimize the marketing margin value.

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SELECTION OF THE BEST FRUITS SUPPLIER BASED ON APPROACH AHP AND TOPSIS METHOD

[1*)] Maria Ulfah, [1)] Dyah Lintang Trenggonowati, [1)] Winda Dwiana

[1)] Department of Industrial Engineering, Faculty of Engineering, University of Sultan Ageng Tirtayasa, Banten, Indonesia

[*)] Correspondence e-mail : maria67_ulfah@yahoo.com

Abstract

The increasing development of the market forced companies to compete globally. Suppliers selection becomes important things that must be considered carefully. Primer Koperasi Karyawan Krakatau Steel is one of the cooperative that has some business areas, one of which is K-Store. K-Store having difficulties in the selection of the best fruits supplier because currently supplier considered have not been able to fulfill the expectations of company. Therefor, K-Store requires selection system in the selection of the best fruits supplier. The method used in the supplier selection are AHP and TOPSIS Methods. AHP is a method used to determine the weight of criteria and sub-criteria. The results of these weights are used as inputs on the TOPSIS method. TOPSIS is a method used to determine the value of preferences by ranking thus the best supplier can be determined. It can be concluded, the best fruits supplier is supplier B.

Keywords: Supplier Selection, AHP and TOPSIS Method, The Best Fruits Supplier

INTRODUCTION

Nowadays, the increasing development of the market forced companies to compete globally. This is a challenge for companies, including retail companies. Retail companies are required to fulfill consumer needs, both in terms of price, quality, and service. The continuous fulfillment of consumer needs properly intends to improve the performance of the company. The key to this performance improvement is the ability of the company to work with its business partners. In retail companies, these business partners are those who supply the needs of companies in various forms. Therefore, the selection of suppliers is the important thing to be considered carefully.

Multiple-criteria decision-making (MCDM) is a sub-discipline of operations research that explicitly evaluates multiple conflicting criteria in decision making. Some methods in MCDM are AHP and TOPSIS. The AHP (Analytic Hierarchy Process) method was first discovered by Dr. Thomas L. Saaty of the Wharton School of Business in 1970. AHP is a method used in the decision-making process of complex issues such as planning issues, alternative determination, prioritization, policy selection, resource allocation, needs determination, forecasting needs, performance planning, optimization, and conflict resolution (Saaty, 1994). TOPSIS is one of the multi-criteria decision-making methods that first introduced by Kwangsun Yoon and Hwang Ching-Lai. The ANP method is a development of the AHP method. The incorporation of ANP method with TOPSIS was first performed by Shyur and Shih in 2006 under the title "a hybrid MCDM model for strategic vendor selection". In the same year, Chen et al conducted a study using the AHP TOPSIS fuzzy method titled "a fuzzy approach for supplier evaluation and selection in supply chain management". Then in 2007 Min Wu conducted a study with AHP TOPSIS with the research title "TOPSIS-AHP simulation model and its application to supply chain management". Based on the results of research conducted by Joseph et al (2013) with the title "comparative analysis of AHP and TOPSIS combined methods with TOPSIS method" it is said that the AHP-TOPSIS method is more accurate than the TOPSIS method whose weight value has high subjectivity. (Yusuf et al, 2013)

Primer Koperasi Karyawan Krakatau Steel (Primkokas) is one of the successful business corporation which has several business fields in Cilegon. Primkokas business field includes savings and loans unit, supermarket unit, and trade unit. This research was conducted in supermarket unit that managed by Primkokas. This unit is called K-Store.

K-Store is one of the retail company that sells daily needs. There are three types of needs sold in this company, these are fresh, food and non-food. Needs of fresh types are fruits, frozen foods, fish, and meat. Needs of food types are snacks, biscuits, bread, and others. Needs of non-food types are cosmetics, detergents, perfumes, and others. Needs of fresh types, especially fruits have specific consideration in the selection of suppliers. Fruits are a type of need that decaying easily so that reduced in quality. Therefor, K-Store must always maintain the good quality of fruits in order to satisfy the costumers. These considerations are necessary to increase sales volume and improve company performance. Therefore, this study focused on the needs of fresh types, especially fruits.

All this time, K-Store has difficulty in the selection of the best fruits supplier because the existing supplier is currently considered not able to fulfill the expectations of the company. To be able to increase fruits sales volume and reduce purchase cost, K-Store must be able to choose the best supplier. This best fruits supplier is expected to provide quality at the right price, the right amount and on time delivery. Therefore, K-Store requires a selection system in the selection of the best fruits supplier in accordance with company standards.

The purpose of this research is to determine criteria and sub-criteria and also the weight value of the criteria and sub-criteria to be considered in the supplier selection, determine the preference value of each supplier alternative and determine the best fruits supplier. The method used in supplier selection are AHP and TOPSIS method. AHP method is used to determine the weight value of criteria and sub-criteria and TOPSIS method is used to determine the value of preference of each fruits supplier alternative based on the ranking thus the best supplier can be determined.

RESEARCH METHOD

This research uses qualitative and quantitative approach. A qualitative approach is conducted to determine the criteria and sub-criteria to be considered in the selection of the best fruits supplier whereas quantitative approach is conducted to calculate the weight of the value of the criteria and sub-criteria considered and calculate the preference value of each fruits supplier alternative. Preference value that obtained then ranked to determine the best fruit supplier.

Primary data in this research obtained from data of interview and questionnaire whereas secondary data obtained from the company in the form of company general data that supports understanding of researcher in reviewing problem existing at the company. The method of data collection is conducted by judgment sampling. Judgment sampling is sampling based on certain considerations. Respondents in this research should have sufficient knowledge and experience on issues, such as the head department of merchandising and warehouse, administration staff of merchandising and warehouse, warehouse supervisor and inventory control supervisor.

The analysis used in this research is using MCDM (Multi Criteria Decision Making) method by integrating AHP and TOPSIS method. AHP method is used to determine the weight value of criteria and sub-criteria and TOPSIS method is used to determine the value of preference of each fruits supplier alternative based on the ranking thus the best supplier can be determined. The data processing of the assessment results is conducted by using a software that can accommodate decision-making models. The software is Super Decision in calculating AHP and Microsoft Excel methods in calculating TOPSIS method. Steps of decision making with the AHP Method (Arbelia and Paryanta, 2014) :

a. Define the problem and determine the solution / goal to be achieved.
b. Create a hierarchical structure consisting of general objectives, criteria, sub-criteria and alternatives.

c. Form a pairwise comparison matrix that describes the relative contribution or influence of each element to each of the objectives or criteria. In this researc, comparative assessment was conducted by four respondents. Thus, whole of answers from respondents should be averaged using a method of averaging called geometric mean. Mathematically the geometric mean formula is written as follows:

$$a_{ij} = (Z_1 x Z_2 x \dots x Z_n)^{1/n}$$

where,

a_{ij} = The mean value of pairwise comparison of elements A_i with A_j for n participants

Z_i = Comparative value between A_i with A_j for participant i, where i = 1, 2, 3, ..., n

n = Number of participants / respondents

d. Normalizes the data by dividing the value of each element in the pairwise comparison matrix with the total value of each column. Based on pairwise comparison matrix thus performed normalization with the steps as follows:

- the weight of each column j is summed, the total column value is denoted by S_{ij}

$$S_{ij} = \sum_{i=1}^{n} a_{ij}$$

- the value of each column divided by the total column value. The result of the division is denoted by V_{ij}

$$V_{ij} = \frac{a_{ij}}{S_{ij}}$$

Where, *ij* = 1,2,3,...n.

- afterwards, computes the relative priority vector of each criterion by averaging the normalized weights on the row. The priority of the criteria is denoted by P_i.

$$P_i = \sum_{i=1}^{n} \frac{v_i}{n}$$

e. Calculates the maximum value of the eigen vector obtained by finding the weights number vector value and priority vectors first. The weights number vector is obtained by multiplying the pairwise comparison matrix average with the priority weight vector (eigen vector) whereas the priority vector is obtained by dividing the weights number vector by the priority weight vector (eigen vector). After obtaining the priority vector value, the value is averaged. The value of the average result is denoted by λ_{maks}

f. Test the consistency of the hierarchy by calculating the consistency index (CI) and the consistency ratio (CR). If CR <0.100 then the assessment should be repeated again. Because the pairwise comparison value on the given criteria and the sub criteria matrix is inconsistent and the relationship between criteria and sub criteria does not logically justify each other. (Rahmayanti, 2010)

The formula of the consistency index is as follows :

$$CI = \frac{\lambda_{maks} - n}{n - 1}$$

Where,

CI = consistency index

λ_{maks} = the maximum value of eigen vector
n = the order of matrix

The formula of the consistency ratio is as follows :

$$CR = \frac{CI}{RI}$$

Where,
CR = Consistency Ratio
CI = Consistency Index
RI = Random Consistency Index

RI values are shown in table 1.

Table 1. Random Consistency Index (RI)

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0,58	0,9	1,12	1,24	1,32	1,41	1,45	1,49

Source : Thomas L. Saaty, 1994

g. Repeats step c to g for the sub criteria hierarchy level.
h. Set the priorities.

In general, the procedure of the TOPSIS method follows the following steps: (Murnawan and Siddiq, 2012)

a) Determine the normalized decision matrix.
TOPSIS requires rating from each assessment on every criterion or sub criteria that is normalized. The normalized decision matrix is formed from the following equation:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \text{ where } i = 1,2,\dots,m; j = 1,2,\dots,n$$

b) Calculates the weighted normalized decision matrix.
The following equation is used to calculate the weighted normalized matrix, it must first be determined the value of weight that represents the absolute preferences of the decision maker.

$$W = w_1, w_2, w_3, \dots, w_n$$

The preference weight value indicates the relative importance level of each criterion or sub criteria in the equation below:

$$V_{ij} = w_j r_{ij} \; untuk \; i = 1,2,\dots,m; j = 1,2,\dots,n$$

c) Determine the matrix of positive ideal solutions and negative ideal solution.
Positive ideal solutions and negative ideal solution can be determined based on the weighted normalized decision rating. It is necessary to note the terms of the previous equation in order to calculate the ideal solution value by first determining whether it is advantageous (benefit criteria) or is disadvantage (cost criteria).

$$A^+ = (y_1^+, y_2^+, \dots, y_n^+)$$
$$A^- = (y_1^-, y_2^-, \dots, y_n^-)$$

Where,

$$y_j^+ = \begin{cases} \max y_{ij}; \text{If j is benefit criteria} \\ \min y_{ij}; \text{if j is cost criteria} \end{cases}$$

$$y_j^- = \begin{cases} \max y_{ij}; \text{If j is benefit criteria} \\ \min y_{ij}; \text{If j is cost criteria} \end{cases}$$

d) Calculating the distance (separate measures) between the values of each alternative with the matrix of positive ideal solutions and negative ideal solution.

e) The distance between alternative A with the positive ideal solutions is formulated as follows:

$$S_i^+ = \sqrt{\sum_{j=1}^{n} (V_{ij} - V_j^+)^2}$$

The distance between alternative A with the negative ideal solution is formulated as follows:

$$S_i^- = \sqrt{\sum_{j=1}^{n} (V_{ij} - V_j^-)^2}$$

f) Calculates the preference value ("relative closeness" to the ideal solution) for each alternative. The preference value (C_i) for each alternative to the following equation:

$$C_i = \frac{S_i^-}{S_i^+ + S_i^-}$$

g) Rank alternatives by score.
Rating the C_i value, the greater C_i value indicates that the alternatives are preferred.

RESULTS AND DISCUSSION

The results and discussion in this research include formation of the best fruits supplier selection hierarchy, the weighting of criteria and sub-criteria, calculation of preference value, and determination of the best supplier. The following described the results and the discussion that has been done in the research:

1. Formation of The Best Fruits Supplier Selection Hierarchy
The following describes the best fruits supplier selection hierarchy that shown in the figure of 1. The describe of codes in the best fruits supplier selection hierarchy is shown in table 2, table 3 and table 4. The following are shown the table 2, table 3 and table 4.

Table 2. Criteria of The Best Fruits Supplier Selection

Symbol	Criteria
QC	Quality
PC	Price
DC	Delivery
SC	Service
CC	The Completeness of Document

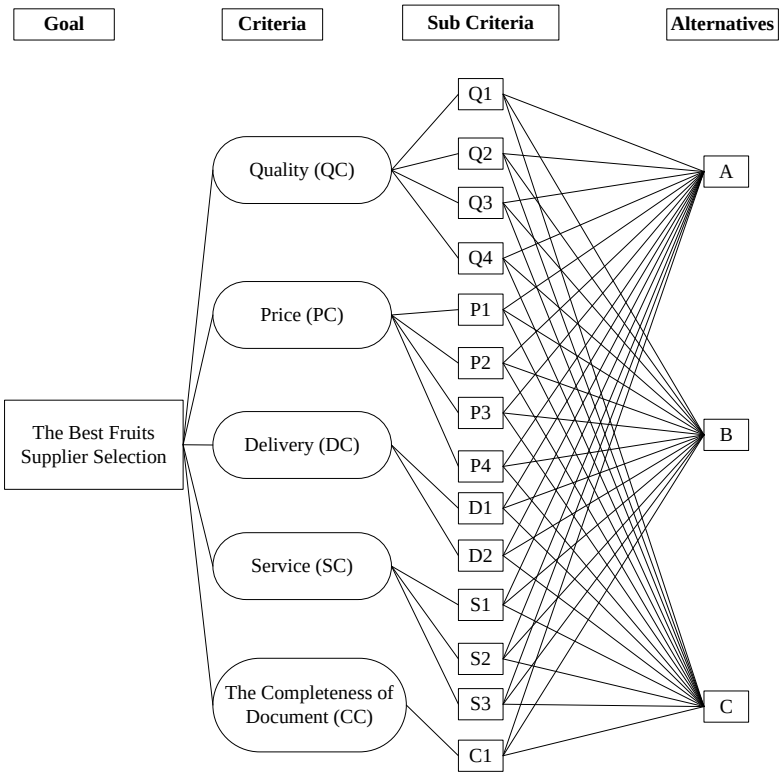

Figure 1. The Best Fruits Supplier Selection Hierarchy

Table 3. Sub-Criteria of The Best Fruits Supplier Selection

Symbol	Sub-Criteria
Q1	Freshness of fruits
Q2	Packaging Conditions
Q3	Willingness of replace damaged product / return product
Q4	Ability of provide consistent quality
P1	Ability of provide competitive prices
P2	Ability of execute product promotion program every certain period
P3	Ability of provide discounts on certain number orders
P4	The ease way of payment
D1	Punctuality
D2	Appropriateness of amount
S1	Easy to contact
S2	Speed in response to demand
S3	Ability of provide information clearly and easily understood
C1	Ability of have complete documents

Table 4. Alternatives of The Best Fruits Supplier Selection

Symbol	Alternatives
A	Supplier A located in West Jakarta
B	Supplier B located in Tangerang City
C	Supplier C located in Cilegon

2. The Weighting of Criteria and Sub-Criteria

The weighting is solved by AHP method to get the weight value from each criteria and sub-criteria. The first step is determine the pairwise comparison matrix which is compiled based on the questionnaire results data that given to four respondents. Table 5, table 6, table 7 and table 8 shown the pairwise comparison matrix of criteria from each respondent.

Table 5. Pairwise Comparison Matrix of Criteria from 1st Respondent

CRITERIA (Zn)	QC	PC	DC	SC	CC
QC	1	1	3	3	1/3
PC	1	1	3	3	1/3
DC	1/3	1/3	1	3	1/5
SC	1/3	1/3	1/3	1	1/5
CC	3	3	5	5	1

Table 6. Pairwise Comparison Matrix of Criteria from 2nd Respondent

CRITERIA (Zn)	QC	PC	DC	SC	CC
QC	1	1/3	3	3	3
PC	3	1	5	5	3
DC	1/3	1/5	1	3	1/3
SC	1/3	1/5	1/3	1	1/3
CC	1/3	1/3	3	3	1

Table 7. Pairwise Comparison Matrix of Criteria from 3rd Respondent

CRITERIA (Zn)	QC	PC	DC	SC	CC
QC	1	5	3	1	1
PC	1/5	1	1/5	1/5	1/5
DC	1/3	5	1	1	1/3
SC	1	5	1	1	1/3
CC	1	5	3	3	1

Table 8. Pairwise Comparison Matrix of Criteria from 4th Respondent

CRITERIA (Zn)	QC	PC	DC	SC	CC
QC	1	5	3	1/3	1
PC	1/5	1	1/5	1/5	1/5
DC	1/3	5	1	1/3	1/3
SC	3	5	3	1	3
CC	1	5	3	1/3	1

In this research, there are four respondents, thus all the answers from the respondents should be averaged with the average geometric mean. The pairwise comparison matrix average of criteria from the four respondents is shown in Table 9.

Table 9. The Average of Criteria Pairwise Comparison Matrix

CRITERIA (*aij*)	QC (j)	PC (j)	DC (j)	SC (j)	CC (j)
QC (i)	1.000	1.695	3.000	1.313	1.000
PC (i)	0.589	1.000	0.880	0.880	0.446
DC (i)	0.330	1.133	1.000	1.313	0.291
SC (i)	0.756	1.133	0.756	1.000	0.506
CC (i)	1.000	2.230	3.409	1.963	1.000
Total (Sij)	3.672	7.192	9.045	6.469	3.240

Example calculation (Table 9) :

- The average of pairwise comparison matrix from quality criteria (i) with price criteria (j)

$$a_{ij} = (Z_1 x Z_2 x \dots x Z_n)^{1/n}$$
$$a_{(QC,PC)} = (1 \; x \; {}^{1}/_{3} \; x \; 5 \; x \; 5)^{1/4}$$
$$a_{(QC,PC)} = 1.695$$

- Number of quality columns in pairwise comparison matrix (S_{ij})

$$S_{ij} = \sum_{i=1}^{n} a_{ij}$$
$$S_{ij} = 1.000 + 0.589 + 0.330 + 0.756 + 0.997$$
$$S_{ij} = 3.672$$

The average of geometric mean is used for normalize the data. Data normalization of criteria is shown in table 10.

Table 10. Data Normalization of Criteria

CRITERIA (Vij)	QC (j)	PC (j)	DC (j)	SC (j)	CC (j)	Priority Weights (Pi)
QC (i)	0.272	0.236	0.332	0.203	0.308	0.270
PC (i)	0.160	0.139	0.097	0.136	0.138	0.130
DC (i)	0.090	0.158	0.111	0.203	0.090	0.130
SC (i)	0.206	0.158	0.084	0.155	0.156	0.150
CC (i)	0.272	0.310	0.377	0.303	0.309	0.310

Example Calculation (Table 10):

- Normalize row of quality (i) and column of quality (j)

$$V_{ij} = \frac{a_{ij}}{S_{ij}}$$
$$V_{(QC,QC)} = \frac{1}{3.672}$$
$$V_{(QC,QC)} = 0.272$$

- Priority weights of the quality criteria

$$P_i = \sum_{i=1}^{n} \frac{v_i}{n}$$

$$P_{QC} = \frac{0.272+0.236+0.332+0.203+0.308}{5}$$
$$P_{QC} = 0.270$$

Thereafter will be calculated consistency ratio to the results of the results of the fourth respondents questionnaire. Before making a consistency ratio calculation, the pairwise comparison matrix average multiplied by the priority weight vector (eigen vector). The new vector is expressed as the weights number vector.

$$\begin{pmatrix} 1.000 & 1.695 & 3.000 & 1.313 & 1.000 \\ 0.589 & 1.000 & 0.880 & 0.880 & 0.446 \\ 0.330 & 1.133 & 1.000 & 1.313 & 0.291 \\ 0.756 & 1.133 & 0.756 & 1.000 & 0.506 \\ 1.000 & 2.230 & 3.409 & 1.963 & 1.000 \end{pmatrix} \text{x} \begin{pmatrix} 0.270 \\ 0.130 \\ 0.130 \\ 0.150 \\ 0.310 \end{pmatrix} = \begin{pmatrix} 1.400 \\ 0.681 \\ 0.662 \\ 0.765 \\ 1.642 \end{pmatrix}$$

Afterward the result of the weights number vector divided by the priority weight vector (eigen vector). This result is expressed by priority vector.

$$\left(\frac{1.400}{0.270} \quad \frac{0.681}{0.130} \quad \frac{0.662}{0.130} \quad \frac{0.765}{0.150} \quad \frac{1.624}{0.310}\right)$$
$$= (5.184 \quad 5.080 \quad 5.083 \quad 5.048 \quad 5.169)$$

After obtained the priority vector, the next step is calculate the average of priority vector. This result is denoted by λ_{maks}.

$$\lambda_{maks} = \frac{5.184 + 5.080 + 5.083 + 5.048 + 5.169}{5}$$
$$\lambda_{maks} = 5.113$$

By getting the value of λ_{maks}, it can be calculated Consistency Index (CI) value with the following formula :

$$CI = \frac{\lambda_{maks} - n}{n - 1}$$
$$CI = \frac{5.113 - 5}{5 - 1}$$
$$CI = 0.028$$

Thus we get the value of Consistency Ratio (CR) with n = 5 and RI = 1.120 with the following formula :

$$CR = \frac{CI}{RI}$$
$$CR = \frac{0.028}{1.120}$$
$$CR = 0.027$$

The result of manual calculation with AHP method that has been done above in accordance with the results obtained by using super decision software. The results obtained based on super decision software are shown in Figure 2.

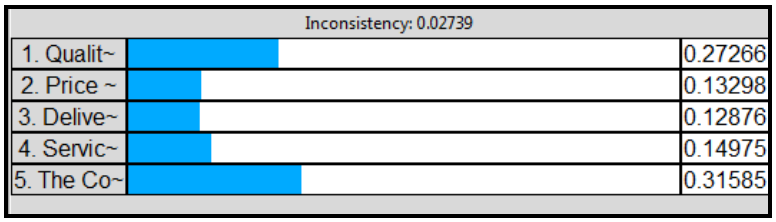

Figure 2. The Results of Criteria Weighting with Super Decision Software

Based on the figure above can be seen that the weight of the criteria sorted from the largest are the completeness of the document amounted to 0.31585, quality amounted to 0.27266, service amounted to 0.14975, price amounted to 0.13298 and delivery amounted to 0.12876. The value of consistency ratio (CR) is 0.02739. If CR <0.1 thus the pairwise comparison value on the given criteria matrix are consistent and the relation between criteria mutually justifies logically.

The calculation to get the weight value of each sub criterion is done in the same way. Table 11 shows the results of the recapitulation of the criteria and sub-criteria weighting values according to the priority sequence that has been obtained.

Table 11. Recapitulation The Results Weighting of Criteria and Sub-Criteria

Criteria	Partial Weight	No	Sub Criteria	Partial Weight	Global Weight
CC	0.316	1	D1	1.000	0.316
QC	0.273	2	K4	0.454	0.124
		3	K1	0.353	0.096
		4	K3	0.102	0.028
		5	K2	0.091	0.025
SC	0.150	6	L2	0.472	0.071
		7	L3	0.271	0.041
		8	L1	0.257	0.038
PC	0.133	9	H1	0.525	0.070
		10	H4	0.269	0.036
		11	H2	0.127	0.017
		12	H3	0.078	0.010
DC	0.129	13	I1	0.770	0.099
		14	I2	0.230	0.030
Jumlah	**1**				**1**

3. Calculation of Preference Value

The weight of the value from each criterion and sub criteria becomes input in determining the preference value of each fruit supplier alternative with TOPSIS method. Based on the results of the questionnaire obtained assessment on each sub criteria for the three fruit supplier alternatives.

The rating scales used to assess each supplier alternatives based on predetermined sub criteria are shown in table 12 regarding document completeness, table 13 regarding packaging conditions and table 14 regarding freshness fruit.

Tabel 12. The Rating Scale of the Document Completeness

Scale	Predicate	Information
1	Very Bad	Do not have company legality documents
2	Bad	Have documents in the form of SITU and NPWP
3	Enough	Have documents in the form of SITU, NPWP dan SIUP
4	Good	Have documents in the form of SITU, NPWP, SIUP, dan TDP
5	Very Good	Have documents in the form of SITU, NPWP, SIUP, TDP dan SPPKP

(Source: The Result of Interview with K-Store)

Table 13. The Rating Scale of Packaging Conditions

Scale	Predicate	Information
1	Very Bad	The packaging conditions are not strong, not neat, not clean, no barcode label, and the contents do not appropriate with the gramation listed on the packaging.
2	Bad	The packaging conditions are less strong, less neat, less clean, no barcode label, and the contents are not in appropriate with the gramation listed on the packaging.
3	Enough	The packaging conditions are strong, neat, clean but no barcode label, and the contents are not in appropriate with the gramation listed on the packaging.
4	Good	The packaging condition is strong, neat, clean but not all have barcode labels, and the contents appropriate with the gramation listed on the packaging.
5	Very Good	The packaging conditions are very strong, very neat, very clean, all have barcode labels, and the contents appropriate with the gramation listed on the packaging.

(Source: The Result of Interview with K-Store)

Rating scale above obtained from the interview with the K-Store to provide an assessment of certain sub criteria on the supplier alternatives. On the other sub criteria, the assessment using likert scale. Based on the assessment that has been given by the four respondents obtained different values on each sub-criteria and alternatives. Therefore, the assessment needs to be averaged. The average assessment is symbolized by the Xij notation where i is the row (sub-criteria) and j is the column (alternatives). The average assessment given to supplier alternatives for each sub-criterion by each respondent is shown in table 15.

Table 14. The Rating Scales of Freshness of Fruits

Scale	Predicate	Information
1	Very Bad	The shape and size of the fruit is not appropriate, the color and cleanliness of the skin is very bad, the flesh is much decayed / perforated, the fruit hardness is uneven, and stink.
2	Bad	The shape and size of the fruit is less appropriate, the color and cleanliness of the skin is bad, the flesh is few decayed / perforated, the fruit hardness is uneven, and stink.
3	Enough	The shape and size of the fruit is less appropriate, the color and cleanliness of the skin is quite good, the fruit flesh slightly decayed / perforated, the fruit hardness is quite evenly and no stink.
4	Good	The shape and size of the fruit is appropriate, color and cleanliness of the skin is good, the flesh is slightly decayed / perforated, the fruit hardness is evenly and no stink.
5	Very Good	The shape and size of the fruit is appropriate, the color and cleanliness of the skin is very good, the fruit flesh is not decayed / perforated, the fruit hardness is very evenly and no stink.

(Source: The Result of Interview with K-Store)

Tabel 15. The Average Assessment of Sub-Criteria to Each Alternative

Sub-Criteria (Xij)	Supplier A	Supplier B	Supplier C
C1	3.25	4.25	3.25
Q4	3.00	4.00	2.25
Q1	3.75	1.75	2.50
Q3	2.50	4.00	2.25
Q2	3.25	2.75	2.75
S2	4.00	2.75	2.00
S3	3.25	3.75	2.75
S1	3.50	2.50	3.00
P1	2.75	3.00	4.00
P4	2.75	3.75	3.00
P2	3.00	2.75	4.00
P3	3.00	3.00	3.75
D1	3.00	3.75	2.75
D2	3.25	4.75	2.50

Example calculation (Table 15) :
Assessment of sub-criteria D1 (i) to supplier A

$$X_{ij} = \frac{penilaian\ 1 + penilaian\ 2 + \cdots + penilaian\ n}{jumlah\ penilaian}$$

$$X_{(C1.supplier\ A)} = \frac{3+3+3+4}{4} = 3.25$$

The first step in TOPSIS method is to determine the normalized decision matrix. The normalized decision matrix is denoted by rij where i is the row (sub-criteria) and j is the column (alternatives). The normalized decision matrix to determine the preference value of each supplier alternative is shown in table 16.

Table 16. The Normalized Decision Matrix

Sub-Criteria (rij)	*Supplier* A	*Supplier* B	*Supplier* C
C1	0.519	0.679	0.519
Q4	0.547	0.730	0.410
Q1	0.776	0.362	0.517
Q3	0.478	0.765	0.431
Q2	0.641	0.543	0.543
S2	0.762	0.524	0.381
S3	0.573	0.661	0.485
S1	0.667	0.477	0.572
P1	0.482	0.526	0.701
P4	0.497	0.678	0.542
P2	0.526	0.482	0.701
P3	0.530	0.530	0.662
D1	0.542	0.678	0.497
D2	0.518	0.757	0.398

Example Calculation (Table 16):
Sub-criteria C1 (i) with alternative suppliers A, B, and C (j)

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}$$

$$\sqrt{\sum_{i=1}^{m} x_{ij}^2} = \sqrt{3.25^2 + 4.25^2 + 3.25^2} = 39.1875$$

$$r_{(C1,supplier\,A)} = \frac{3.25}{\sqrt{39.1875}} = 0.519$$

$$r_{(C1,supplier\,B)} = \frac{4.25}{\sqrt{39.1875}} = 0.679$$

$$r_{(C1,supplier\,C)} = \frac{3.25}{\sqrt{39.1875}} = 0.519$$

The second step in the TOPSIS method is to determine the weighted normalized decision matrix. The weighted normalized decision matrix to determine the preference value of each supplier alternative is shown in table 17.

Example Calculation (Table 17) :
Sub Criteria C1 (i) with alternative suppliers A, B, and C (j)

$$V_{ij} = w_j r_{ij}$$
$$V_{(C1.supplier A)} = 0.316\ x\ 0.519 = 0.164$$
$$V_{(C1.supplier B)} = 0.316\ x\ 0.679 = 0.214$$
$$V_{(C1.supplier C)} = 0.316\ x\ 0.519 = 0.164$$

Table 17. The Weighted Normalized Decision Matrix

Sub-Criteria (Vij)	Weight (wj)	*Supplier* A	*Supplier* B	*Supplier* C
C1	0.316	0.164	0.214	0.164
Q4	0.124	0.068	0.090	0.051
Q1	0.096	0.075	0.035	0.050
Q3	0.028	0.013	0.021	0.012
Q2	0.025	0.016	0.013	0.013
S2	0.071	0.054	0.037	0.027
S3	0.041	0.023	0.027	0.020
S1	0.038	0.026	0.018	0.022
P1	0.070	0.034	0.037	0.049
P4	0.036	0.018	0.024	0.019
P2	0.017	0.009	0.008	0.012
P3	0.010	0.006	0.006	0.007
D1	0.099	0.054	0.067	0.049
D2	0.030	0.015	0.022	0.012

The third step is to determine the matrix of positive ideal solutions and the negative ideal solution. Positive ideal solutions and negative ideal solutions can be determined based on the weighted normalized decision matrix. Based on table 16, we determine the ideal solution value (maximum or minimum) in each criterion by first determining whether the criterion is beneficial (benefit criteria) or disadvantage (cost criteria). In this research, all sub criteria are beneficial (max) on the value of positive ideal solutions and disadvantage (min) on the value of negative ideal solution positive. The matrix of positive ideal solutions and negative ideal solutions are shown in table 18.

The fourth step is to calculate the distance between the value of each alternative with a positive ideal solution matrix and the ideal negative solution matrix. The distance of S + and S- on each supplier alternative is shown in table 19.

Example Calculation (Table 19):
The distance between alternative of supplier A with the positive ideal solution

$$S_i^+ = \sqrt{\sum_{j=1}^{n} (V_{ij} - V_j^+)^2}$$
$$S_A^+ = \sqrt{(0.164 - 0.214)^2 + \cdots + (0.015 - 0.022)^2}$$
$$S_A^+ = 0.060$$

The distance between alternative of supplier A with the negative ideal solution

$$S_i^- = \sqrt{\sum_{j=1}^{n} (V_{ij} - V_j^-)^2}$$

$$S_A^- = \sqrt{(0.164 - 0.164)^2 + \cdots + (0.015 - 0.012)^2}$$

$$S_A^- = 0.052$$

Table 18. The Matrix of Positive Ideal Solutions and Negative Ideal Solutions

Sub-Criteria (Vj)	A+ (*max value*)	*A-* *(min value)*
C1	0.214	0.164
Q4	0.090	0.051
Q1	0.075	0.035
Q3	0.021	0.012
Q2	0.016	0.013
S2	0.054	0.027
S3	0.027	0.020
S1	0.026	0.018
P1	0.049	0.034
P4	0.024	0.018
P2	0.012	0.008
P3	0.007	0.006
D1	0.067	0.049
D2	0.022	0.012

Table 19. The Distance of S + and S-

Alternatif *Supplier* (Si)	S^+	S^-
A	0.060	0.052
B	0.046	0.070
C	0.078	0.022

The fifth step is to calculate the preference value ("relative closeness" to the ideal solution) for each alternative. The preference value (relative closeness) of each alternative is shown in table 20.

Table 20. The Preference Value of Each Alternative

Alternatif *Supplier*	Nilai Preferensi (Ci)
A	0.463
B	0.604
C	0.221

Example Calculation (Table 20) :

$$C_i = \frac{S_i^-}{S_i^+ + S_i^-}$$

$$C_A = \frac{0.052}{0.060 + 0.052} = 0.463$$

$$C_B = \frac{0.070}{0.046 + 0.070} = 0.604$$

$$C_C = \frac{0.022}{0.078 + 0.022} = 0.221$$

Based on the above calculation, obtained the preference value of each fruit supplier alternative in Primer Koperasi Karyawan Krakatau Steel especially in K-Store unit with TOPSIS method. The preference value of supplier alternatives are supplier A amount to 0.463, supplier B amount to 0.604 and supplier C amount to 0.221.

4. Determination of The Best Supplier
   The rankings of supplier alternatives based on preference values are shown in table 21.

Table 21. Ranking Alternative Supplier

Supplier Alternatives	Preference Values (Ci)	*Ranking*
A	0.463	2
B	0.604	1
C	0.221	3

Based on the above table, it can be seen that the best fruit supplier in Primer Koperasi Karyawan Krakatau Steel especially in unit K-Store is supplier B located in Tangerang City.

CONCLUSION

Based on the result and discussion, we get the weight of value for each criteria and sub-criteria into consideration in the selection of suppliers those are the completeness of document amount to 0.316, the quality amount to 0.273, the service amount to 0.150, the price amount to 0.133, and the delivery amount to 0.129 while the weight value for each sub-criteria are the ability of have complete documents amount to 0.316, the ability of provide consistent quality amount to 0.124, the freshness of fruits amount to 0.096, willingness of replace damaged product / return product amount to 0.028, packaging conditions amount to 0.025, speed in response to demand amount to 0.071, the ability to provide information clearly and easily understood amount to 0.041, ease of contact amount to 0.038, ability of provide competitive prices amount to 0.070, the ease way of payment amount to 0.036, ability of execute product promotion program every certain period amount to 0.017, ability of provide discounts on certain number orders amount to 0.010, the punctuality amount to 0.099 and the appropriateness of amount amount to 0.030. The preference value of each supplier alternative are supplier A amount to 0.463, supplier B amount to 0604 and supplier C amount to 0.221. So it can be concluded, the best fruit supplier that is supplier B located in Tangerang City.

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IMPROVING FOR INDONESIAN BEEF SUPPLY CHAIN MODEL

[1*)] Sirajuddin, [2)] Syarkawi Rauf, [3)] Dedi Sani

[1)] Department of Industrial Engineering, University of Sultan Ageng Tirtayasa, Indonesia.
[2)] Commission for the Supervision of Business Competition, Indonesia.
[3)] Department of Economic, Hasanuddin University, Indonesia.

*) Correspondence e-mail :

Abstract

This paper describes the model of beef supply in Indonesia. Beef products are one of 11 strategic food priorities of the Indonesian government. There are two main problems to solve, that is food security and high meat pricing. The price of meat in Indonesia tends to fluctuate and this price was above Rp. 110.000. Therefore, it is necessary to formulate the supply chain model of meat to see the cause of this high cost and the availability of food, especially beef in Indonesia. Next, we have to formulate policies that must be done to fix the problem of national scarcity and the national meat price. Through a survey that conducted to the feedlot, slaughterhouses, traditional markets, and cattle farms in various regions of Indonesia, it can be concluded that the cause of high meat prices is due to limited supply from feedlot to slaughterhouses in 2016, where the prices in Jabodetabek reached Rp. 140,000. This limited supply was because there was supply delay from feedlot to slaughterhouses so that the slaughterhouses cannot fulfill the market demand. This is why the price in the market reached Rp. 140,000. Seeing this problem, through Focus Group Discussion between the ministry of agriculture, cattle fattening companies and slaughterhouses, they formulated recommendations to the government in fixing the beef supply chain in order to fulfil the beef national demand, such as the removal of import quotas to tariff-based, strict supervision to the company cattle importers to distribute to slaughterhouses on time, enforcement law to importers and feedlot who intentionally holding back the beef supply. In addition, to reduce the price of cattle in the market, the government needs to import frozen beef and produce buffalo meat to substitute beef.

Keywords : food security, meat supply chain, meat price

INTRODUCTION

The Food is anything derived from biological sources of agricultural, plantation, forestry, fishery, animal husbandry, sound, and air products, whether processed or unprocessed for food or beverage for human consumption, including Food additives, Foodstuffs, and other materials used in the process of preparing, processing, and/or making food or drink (food law, 2012). In The Rule of the Republic of Indonesia Number 18 The year 2012 about Food was defined Food Security was a condition of the fulfillment of Food for the state up to the individual, which is reflected in the availability of adequate food, both quantity, and quality, safe, diverse, nutritious, equitable, and affordable and not contrary to religion, and community culture, to be able to live healthy, active, and productive in a sustainable manner. The Indonesian government has set 11 food commodities that become the national priority agenda. This was done to ensure the safe food for the community. (Ministry of Agriculture, 2012). These commodities are rice, sugar, onion, garlic, chicken meat, beef, eggs, salt, corn, cooking oil, and red pepper (FAO, 2012).

This paper only studies about beef cattle as a source of protein needs of the Indonesian community. From the data of the Ministry of Indonesian Agriculture, the importation of beef cattle in 2013 reaches 80,000 tons of meat equivalent. This amount is 13% less than the 2012 import allocation weighing 92,000 tons. The details of the 2013 import quota are 48,000 tons of meat, equivalent to

288,000 head of cattle, and 32,000 tons of frozen beef. To fulfill these needs, the importers of beef and cattle importers for 2013 has been set as many as 100 companies that have licenses as registered importers (IT). Details, 80 meat importers and 20 importers of beef cattle. In relation to the Program of Self-Sufficiency for Beef / Buffalo (PSDSK) Year 2014, the government has sought various breakthroughs to increase the production and productivity of local cattle, in order to fulfill domestic meat needs. Along with the increasing supply of domestic beef through local production, the need for importation of meat and/or offal from abroad gradually from 2010 - 2013 has decreased (Ministry of Agriculture, 2014).

The concept of quota allocation through the import mechanism of beef cattle, the import of innards and buffalo meat has not been able to solve the problem of meat availability. Especially, since the Meat self-sufficiency program targeted in 2014 has not been achieved yet (KPPU, 2016). Moreover, importers from cattle fattening companies that have received inconsistent import allocations and direct supply to the market based on allocations in the quarter that have been established cause the needs in the meat market are distorted. In addition, the current breeder concept is still a subsistence farmer, which is not economic-oriented, not land-based, livestock is often an independent need and meets the needs of big holidays (Ministry of Trade, 2016) (ICBFA, 2016).

Therefore, the research will examine the supply chain model of beef in Indonesia that can provide comprehensive solutions on how the national model of beef fulfillment is cheap and also provide a multiplier effect on the welfare of farmers (Ministry of Agriculture, 2012 & Filho, 2004).

RESEARCH METHOD

The method used in this study is the literature study of various policies that have been done by the government and various journals that have been published about the concept of supply of beef chain nationally in meeting national needs such as (Bosona, 2013; EIU, 2008; FAO, 2012; Pizzuti, Mirabelli, Grasso, & Paldino, 2017; Zulfakar, 2015). Literature study is also done through the collection of various government policies on food, especially the national meat policy in the fulfillment of meat needs in Indonesia.

In addition, we have also conducted surveys in the feedlot, slaughterhouses, traditional markets, and cattle farms in various places such as feedlot in Tangerang, Bandung, Subang. After that, we were discussing in focus group discussion with various stakeholders such as the Ministry of Agriculture of Indonesia, Ministry of Trade of Indonesia, feedlot entrepreneur, meat importer, and Indonesian competition authority.

RESULT AND DISCUSSION

In a group discussion, we have been elaborated on the mechanism of applying the allocation of beef imports. For example, in 2013, the division of quotas per importer is carried out in accordance with the mechanism set forth in Permentan no. 50/2011 and Permendag no. 24/2011. The allocation of beef imports in 2013 shall be stipulated in the Coordination Meeting of the Ministerial Level, chaired by the Coordinating Minister for Economic Affairs as stipulated in Article 4 of Permentan No. 50/2011 (in accordance with national needs analysis determined through a coordinated meeting of ministerial level coordinated by Coordinating Minister for Economic Affairs) and Article 3 paragraph (4) Permendag No. 24/2011. The Coordination Meeting was held on November 28, 2012, and has decided the allocation of national import of beef in 2013 by 80,000 tons, consisting of 60% import in beef cattle (267,000 head of cattle or equivalent 48,000 tons of meat) and 40% import in beef (32,000 tons). The Limited Meeting also decided that the issuance of Recommendation and Import Permit is done once, but still divides the period of income per semester according to Permentan no. 50/2011 and Permendag no. 24/2011 (Ministry of Agriculture, 2016)

The pattern of government policy to meet the needs of beef is not effective. The supply of beef to the market is still stagnant, so the need of meat in the market is still not fulfilled. From surveys conducted and direct interviews with slaughterhouses, there is sometimes a shortage of stock because there is no cattle supply from feedlot when it has been commissioned by the government to import livestock (Colella & Ortega, 2017).

In addition, the most important thing is the movement of uncontrolled beef prices to reach the RP. 110.000 / kg - 140.000 / kg. This is a major obstacle and problem for the government, especially in the fulfillment of food and nutrition of the community. In Figure 1. The price trend of beef in 2013 and 2014 is between Rp. 60,000 - Rp. 70.00. but in 2014 and 2015 experienced a very significant increase in the price of Rp.100.000 - Rp.110.000 (ICBFA, 2016).

In addition, the price of beef is also affected by the composition of meat from beef cattle. The weight of live cattle that have been fattened on average 532 kg (25 inches), and 25% (blood, and other impurities) as in Picture.1. So if we buy beef cattle Rp. 22,000,000 with a living weight of 532 kg, so that can be converted to meat only 50% of 532 kg of 266 kg. So, the price of beef in slaughterhouses is still in the range of Rp. 82,706 plus the transportation cost of Rp. 10,000 and Profit Rp. 10.000 / kg than the price at the level of slaughterhouse of 102,706. So very reasonable if the price at the consumer level reached Rp.120.000 s.d 140.000, moreover there is action to withstand the supply from the feedlot. even though there are still additional benefits that can be obtained from 25% off (offal, head, legs, skin), and 25% (blood, and other impurities) as in picture.1

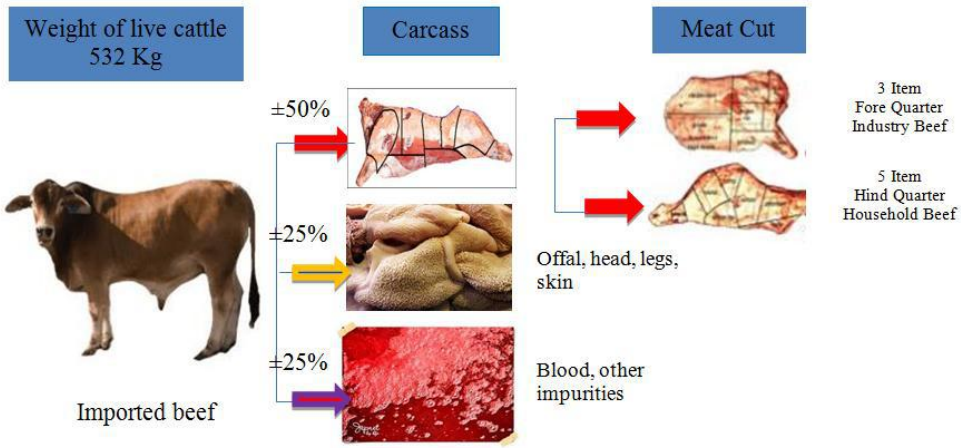

Figure 1. Cow's Composition to Beef
Source: Guntara and (ICBFA, 2016)

The trend of meat price increase in 2016, is quite unique because the same thing happened in 2010-2014 where the average price rose in July and will continue to increase until August especially on religious holidays. When compared with other countries, the price of meat in Indonesia is still very expensive. In 2012 the price of beef in Malaysia is the US $ 4.3, Thailand, US $ 4.2, Australia US $ 4.2, Japan US $ 4. Germany US $ 4.3, India US $ 7.4 and Indonesia US $ 9.76.

The price distortion between other countries and Indonesia is huge. This causes the flood of food products, especially beef in Indonesia because the price is cheaper than other countries so that food, especially national production meat can not compete with beef from outside. (Filho, 2004). In addition to the cheaper price factor in the international world. The deficit of national livestock product supply at a rate of 3-4% per year, is also a determinant of the beef import decision.

Table 1. List of Beef Prices December 2012

No	Country Name	Meat Price (US$)	Meat Price (1 US$ = Rp.13.000)
1	Malaysia	4.3	55,900
2	Thailand	4.2	54,600
3	Australia	4.2	54,600
4	Japan	4	51,688
5	Germany	4.3	55,900
6	India	7.4	96,200
7	Indonesia	9.76	126,880

Source; (FAO, 2012) & (World Bank, 2013)

Table 2. Meat Balance and Cattle and Buffalo Population Development

No	Component	2013	2014	2015	2016	2017	2018	2019	Growth 2015 - 2019
1	Consumption of meat per capita (kg/capita)	2.25	2.36	2.48	2.61	2.75	2.9	3.07	5.4
2	Number of population (million people)	248.8	252.2	255.5	258.7	261.9	265	268.1	1.23
3	Meet consumption needs (thousand)	559.8	595.1	633.5	675.2	720.2	768.5	823	6.7
4	Total local beef and buffalo production	383.3	403.1	414.2	425.6	437.3	449.4	461.8	2.76
5	Equivalent population (thousand tails)	2,253.0	2,369.0	2,434.3	2,501.3	2,570.3	2,641.3	2,714.	
6	Surplus/deficit (thousand tons)	-176.5	-192	-219.3	-249.6	-282.9	-319.1	-361.2	-3.94
7	Equivalent cattle (thousand tails)	929.1	1010.7	1154.6	1313.9	1488.9	1679.8	1901	
8	Meet Imports (thousand ton)	175.4	320	219.4	249.6	282.9	319.1	361.2	4.33
9	Level of Food Security (%)	68.5	67.7	65.4	63	60.7	58.5	56.1	
10	Early population (thousand tails)	14240.1	14676.4	15079.6	15494.4	15921	16359.8	16811.2	2.75

Source: Bappenas (2015), Ministry of Agriculture (2016), (ICBFA, 2016)

The supply chain import flow of cattle started from Australian farmers. In the rainy season, Q4 and Q1 prices in Australia are rising, while prices in Q2 and Q3 are falling. At the time, the price drops the export Australia such as Elders, ILE, Willard, Ellen, Frontier, Austrex, SEAL export cattle with prices ranging from USD 2.7 - 3.3 USD / kg of live cattle. After that, the cattle were sent through the shipping through the system join the feedlot. So, in this shipping process also cause delays due to the small volume at the time of delivery as it waits until full for shipment. At the time the cow has arrived in Indonesia. After that, Cows should be checked through quarantine with the cost of handling and the old quarantine about 14 days. Then, transported to the feedlot cage. The cattle fattening process occurs in the feedlot for 3-4 months and then sent to a slaughterhouse which then is sent to wholesalers and Retailers stalls in the market or directly to consumers.

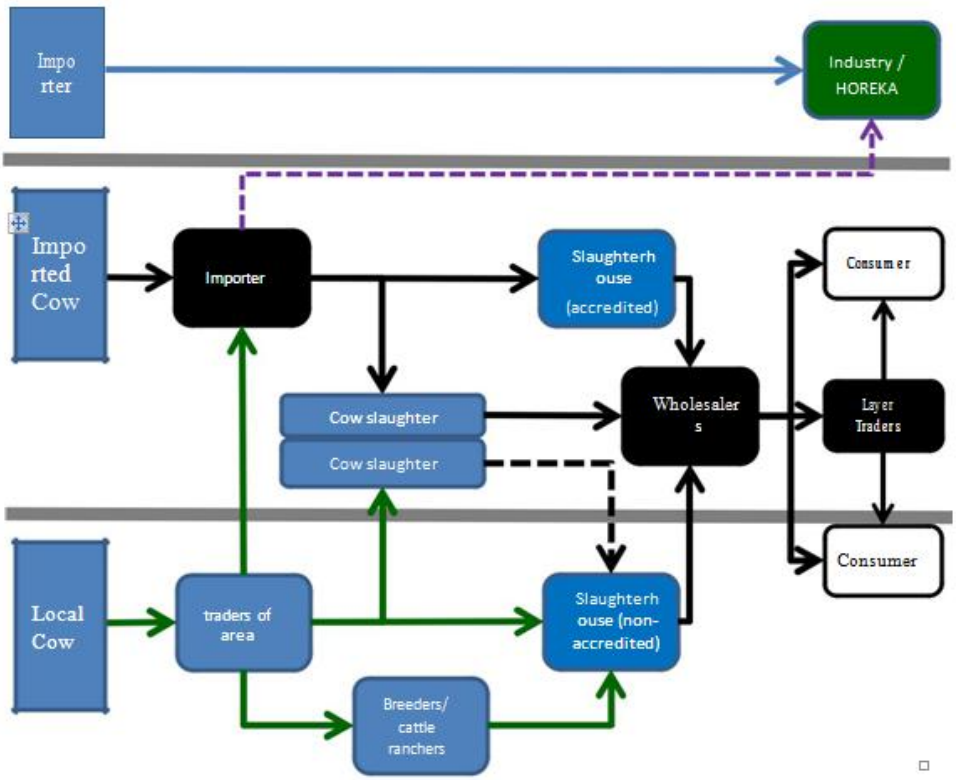

Figure 3. Model Supply Chain of Beef
Source: Results Discussion with KPPU, 2016 and (ICBFA, 2016)

CONCLUSION

There are several reasons why the increase in beef prices. One reason is the lack of supply from fattening to slaughterhouses. Reduction of supply to slaughterhouses (Cartel) should not occur because the government has given trust to importers to import based on quotas given. importers and feedlots should distribute directly to slaughterhouses to avoid the scarcity of meat supply on the market or consumers. Another thing that is also a technical obstacle in meeting the availability of livestock is the production in Indonesia and the type of livestock that can be developed that is Bali livestock and the concept of livestock are still traditional. So that home cattle can not compete with livestock for Australia because of different livestock varieties so that the availability of this cow can not be overcome

by import mechanism alone. Therefore, to increase the availability of national meat there must be strategic steps such as :

1. Improvement of local cattle production centers based on cooperatives and corporations
2. Providing assistance to breeding cattle
3. Change of import quotas system to tariff-based system
4. Provide administrative fines to the export or import, or to feedlot who intentionally withholds the supply of beef
5. Open import ports for cattle to reduce distribution costs.
6. There is a definite data about the need and production of cattle for consumption and trade in the market.
7. Strict supervision of imported cattle importers to distribute to the slaughterhouse on time, enforcement law to importers and feedlot who intentionally withhold the supply of beef.
8. To reduce the price of cattle in the market, the government needs to import frozen beef and create buffalo meat for beef substitution.

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THE DEVELOPMENT OF EFFECTIVE BUSINESS STRATEGY MODEL TO IMPROVE COMPETITIVENESS OF SMALL - SCALE RESTAURANT

[1*)] Hartomo Soewardi, [1)] Muhamad Soleh

[1)] Magister of Industrial Engineering, Islamic University of Indonesia, Yogyakarta

[*)] Correspondence e-mail : hartomo@uii.ac.id

Abstract

Business competition in small restaurant enterprises is more stringent than large enterprises. This is due to the growth so fast. Therefore, they cannot compete with other restaurants that have a better concept and strategy. The objective of this study is to develop an effective conceptual model of business strategy for small restaurant enterprises that can be used as a reference for establishing new culinary business. Axiomatic design is used to determine design parameters of a business strategy model based on the customer requirements. Verification test is cunducted to prove that the proposed conceptual model has been satisfied theoretical and empirical principles. While Homogenity test is used to test the hypothesis that design parameters developed can meet customers' needs. The result of this study shows that the specification design of culinary business is valid to meet customer criteria which covering attractive product, perceived quality and nice place at 5% of significant level. This study also results in an effective conceptual model of business strategy that encompasses 1) the design of various of food and beverage, 2) The design of effective business management, 3) The design of a pleasant place and facilityies which it is valid to satisfy the theoretical principle at 5% significance level.

Keywords: strategy, business model, axiomatic design.

INTRODUCTION

Eating and drinking are basic human needs. However, it does not seem to apply anymore nowadays. As the development of the civilization and the era of information that have grown up and it changed the pattern of community life. It has become a new lifestyle among the people and became a culinary industry that provide not only tastes, but also other human needs for socializing and actualizing. The culinary industry that develops today also provides space for consumers to get together with their community through room service or other services. As a result, the food or restaurant business continued to rise from year to year (Wahyu. 2015).

The high potential and culinary business opportunities lead to many entrepreneurs who try to build a culinary business. In Yogyakarta, there were 83 thousand units of Small and Medium Enterprises (SMEs), 50 percent of which were dominated by industry in the field of food (Skalanews, 2014). Based on GPMMI data in Jawapos (2014), 70 percent of players in the culinary business were small and medium-sized entrepreneurs. Business competition in the area of small and medium enterprises in this industry is generally more stringent than a large-scale culinary business.

Table 1. showed the growth of small-scale restaurant business from 2010 to 2015. Based on these data it can be seen that the culinary business increased up to 145% in 2011. However, in 2012 and 2014 the number of small-scale restaurants decreased around 40% to 54%. This means, the failure rate of small-scale restaurant from 2010 to 2015 is quite high. This is because nowadays people are smarter and selective in choosing places to eat. In addition, not only the competition among small businesses, but also faced with a large - scale restaurant that have a better restaurant concept than small-scale. They still uses a traditional restaurant planning with venue and facility which doesn't meet the standard of the restaurant. Meanwhile, competitors have an interesting restaurant concept and

effective marketing strategies such as a variety products of food and beverage, comfortable venue, complete facilities and attractive promo.

The demand of a lot of consumers is definitely something to be noticed by the company, which in essence, consumers want to get maximum satisfaction in using products or services. There are two effective strategies to attract customers. First, the company must pay extraordinary attention to the customers through excellent services and qualities. Second, the company must keep innovating (Emilia and Zuzana, 2006; Tom and Nancy, 1985). Meaning to be able to attract new customers, the company must provide quality products in accordance with the demand of customers. Meanwhile, to maintain the customers, companies must provide satisfactory services and keep innovating. It takes a strategy designing method that can precisely translate the demand of customers into a strategic concept.

Table 1. Small Business Restaurant/Restaurant Development in Indonesia by 2010 – 2015

Year	Amount	Development (%)
2010	48.320	7.84
2011	118.403	145
2012	70.712	-40
2013	158.651	124
2014	73.066	-54
2015	93.814	28

Source: Central Bureau of Statistics, 2016

Previous research related to designing a business strategy has been conducted by some researchers such as Mazzarol (2004) which has conducted the design of small business strategy management. Engelhardt and Nordlund (2000) undertook design strategies based on Axiomatic Design. Maryam *et al*. (2012) conducted strategy planning for lubricant companies. Maria and Sharon (2001) use an axiomatic design approach to design business processes. Norailis and Syarizal (2013) conducted benchmarking for Small and Medium Enterprises (SMEs) in Malaysia. Josee and Louis (2004) analyzed the effects of benchmarking on the performance and manufacturing processes of Small and Medium Enterprises. Patricia *et al*. (2005) conducted a literature review and practice to stimulate the process of qualitative growth in SMEs. The purpose of this study is to identify benchmarking types and tools which support the qualitative growth of the company.

Engelhardt and Nordlund (2000) argued that Axiomatic Design can be used to design a company strategy that suited the customer's specific needs and at the same time ensured that the company's goals and vision can be achieved by planning actions to be taken. Providing customer satisfaction, not only provide quality of the products, culinary business should provide quality services to customers (Zeithaml, 1985, Martinich, 1997). Therefore, this research will apply axiomatic design method to design strategy for new company that focus on customer's need in order to produce culinary business concept that can survive and win the competition.

RESEARCH METHOD

Object and Subject of the Research

The research object was the attribute of customer demand to small-scale restaurant business in Yogyakarta. The number of subjects for the distribution of questionnaires was using the develop formula by Nurhayati (2008). Based on the calculation with 90% confidence level and the level of accuracy (α) 10% = 0.1 obtained 68 respondents consisting of culinary lovers in Yogyakarta.

Research Procedure

A. Data Collection

The required data consists of primary and secondary data. Primary data were obtained by spreading questionnaires to find customers' demand towards the small-scale restaurant. Meanwhile, the secondary data obtained by literature study, direct observation and interview with several small-scale restaurants in Yogyakarta that have been successful such as Waroeng Special Sambal, SambelLayah, Lesehan Aldan.

B. Homogeneity Test

Homogeneity test is used to test the hypothesis that developed design parameters can meet customers' needs. Homogeneity test is conducted to find out whether the design parameters in axiomatic design are in line with the demand of customers or not. This test is conducted by comparing the reviewers before the design with customer ratings to the design of the axiomatic parametric design. The hypothesis is defined as a tentative conclusion in a study. The hypothesis proposed in this homogeneity test is :

H_0= There is no difference in outcomes between customer desires and parameter design
H_1 = There is a difference between customer desires and parameter design

If the value is significant or Asymp, Sig. (2-tailed) is greater than probability 0.05 then H_0 is rejected. It has meaning that there is no difference between customer's desires and parameter design.

C. Verification Test

Verification test is cunducted to prove that the proposed conceptual model has been satisfied theoretical and empirical principles. The test is conducted by asking the model to the expert in the field of restaurant business strategy, whether it is in accordance with the theory and empirical study.

D. Design Concept

To design a small-scale restaurant, it needs to perform the analysis of consumer demand at the restaurant, because in the restaurant business process not only offer the product but also the service, the dimension of product and service quality is used as a reference in the identification of customer desire. Customer attributes obtained from the analysis of customer desires made the basis of the design strategy using axiomatic design. Engelhardt and Nordlund (2000) stated that the stages in the axiomatic design were defining customer attributes (CAs) derived from the analysis of the voice of customers in the previous stage. The next stage is to map the Functional Requirement (FR) and Design parameters (DP) Functional Requirement determined by Customer Attributes. In designing a business strategy, Functional Requirement can also be defined as a goal. The next step is to determine the Design Parameter to respond the Functional Requirement. Design parameters in the design strategy can be defined as a strategy to reach the goal (Functional Requirement).

The Axiomatic Design Approach was developed by Dr. Nam P. Suh in the mid-1970s with the aim of developing scientific, general, codified, and systematic procedures in design (Cochran et al., 2000). Systematizing the thinking process and create a dividing line between the various design activities, the four domains are the basis of the Axiomatic design procedure.

These domains are defined as follows (Suh, 1990; Laura, 2005) :

Customer Domain	:	Containing what your customers need (CAs) and their attributes and what they think about when buying a product
Functional Domain	:	Functional Requirement is needed to define the purpose of the design. Functional Requirement should be arranged in a tiered structure of at least 3 levels. Level 1 FR must state overall design requirements based on customer needs. From level 1, the requirements can be made in a hierarchical structure based

		on the decision which is taken using the axiomatic design process
Physical Domain	:	Containing design parameters / Design Parameters (DPs) of systems that meet functional requirements
Process Domain	:	Containing the process variables used to generate DPs to realize the solution

To transform the axiomatic design into a strategic design tool, the FRs is changed into "Goal", DPs becomes "Strategy", and PVs translates into "Activity" or detail of strategy derived from parametric design. Meanwhile, customer needs remain as customer needs (Engelhardt and Nordlund, 2000).

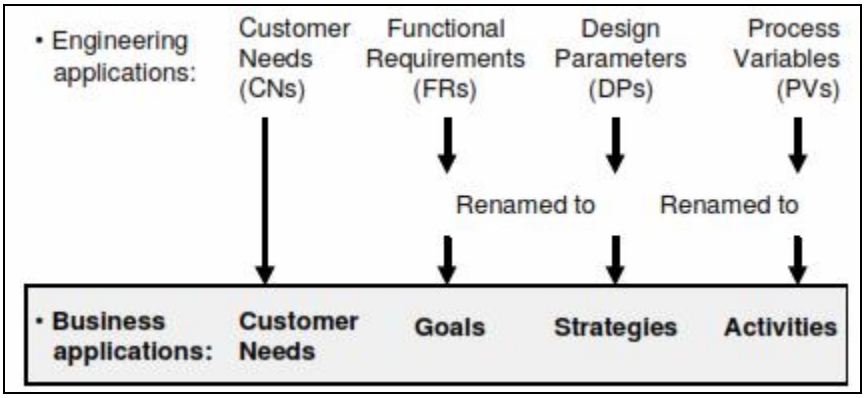

Figure 1. Axiomatic design implemented as a strategic planning
Source: Engelhardt and Nordlund (2000)

The usage of Axiomatic design as a planning tool and strategy design is closely related between the goals and strategies which is obtained. A strategy is needed to meet the goal. Activities are tasks and actions that enable the successful execution of a strategy. Using an axiomatic design as a strategic planning tool can minimize the contradiction and overlap of goals, strategies and activities (Engelhardt and Nordlund, 2000).

RESULTS AND DISCUSSION

Questionnaires distributed to respondents consisting of culinary lover which located in Yogyakarta. The results of questionnaires distribution determine the consumers' desire the eating level of their interest which can be described as follows: Portion of filling food (4), Food products which served very delicious (4), Food taste is always consistent (4), Menu which offered is always available (4), Wrong order must be replaced soon (4) Plating food (4), food hygiene (4), chili sauce variation (4), Traditional Salad (Lalapan) (3), Snacks are available (3), Variation of beverage (4), Corporate Reputation (3), Good quality standard of restaurant (4), quiet and comfortable dining room (4), Employee is able to serve customers (4), easy restaurant location (4), The speed of serving food (4), Order delivered according to the order of customers (5), Waiter/waitress is responsive towards customer complain (4), Waiter/waitress reply the customer's questions with a friendly method (4), Small-scale restaurant is safe from all crimes (5), Food served is fresh and halal (5), Small-scale restaurant understand what the customer wants (4).

The customer data above desires are grouped by factor analysis method. The result of grouping factor analysis is described in the attribute of customer desires. Questions a12, a13, a11, a10 are described as various product menus, questions a1, a2, a3, a4, a9 are described as product attractiveness and the two groups are defined to be attributes of Attractive Product which means that

the product offered make the customer want to buy back. Meanwhile, the questions a5, a6 are described to be the consistency of the product taste, a14, a15, b6, b5, b9 is described based on restaurant names, b10, b7, a7, a8, b8 are described as a restaurant service and b4, b2 is described as employee ability. The four groups are defined as attributes Perceived Quality which means that the restaurant has a good reputation in the eyes of customers. Meanwhile, the third attribute is the attribute of Nice Place which means the restaurant makes the customer comfortable and do not find any difficulties gained from questions b1 and b3

Based on the results of grouping factor analysis, it is obtained Customer Requirements (CRs) shown in table 2.

Table 2. Mapping of Customer Requirements (CRs)

Description	Code	Customer Attribute	Explanation
Various Menu Interesting product	CA1	*Attractive Product*	Product of restaurant can make customers want to buy back
Consistent taste of Product Reputation of a Restaurant Service Worker Ability	CA2	*Percieved Quality*	Restaurant has a good reputation
Place	CA3	*Nice Place*	Customers feel comfortable in the restaurant

In the process of axiomatic design, Functional Requirement is determined by Customer Attributes. In designing a business strategy, Functional Requirement can also be defined as a goal. The next step, the researcher determines the Parameter Design and responds the Functional Requirement. Design Parameters in the design strategy can be defined as a strategy to meet the goal (Functional Requirement). The decomposition process from FRs to DPs is described in Figure 3.

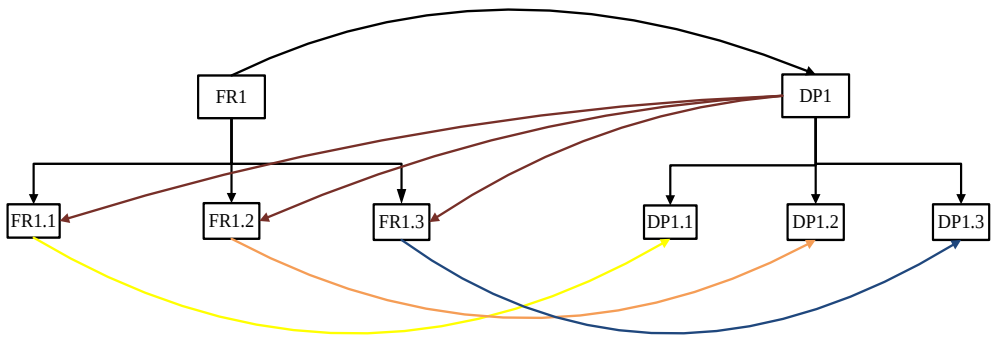

Figure 2. Decompotition Process from FRs to DP

Design Mapping from CAs to FRs

Table 3. Mapping from CAs to FRs

Code	Customers Attribute	Code	Functional Requirements
CA1	Attractive Product	FR1	Increase the appetite
CA2	Perceived Quality	FR2	Increase Customer Trust
CA3	Nice Place	FR3	Improve the Comfort of a restaurant

Design Mapping from FRs to DPs

Mapping Process from FRs to DPs shown in table 4.

Table 5. Design Mapping from FRs to DPs

Code	Functional Requirements	Code	Design Parameters	Code	Variabel Process
FR1	Increased appetite	DP1	The design of various of food and beverage	PV1	List menu of Small-scale restaurant
FR1.1	Provides a large selection of food	DP1.1	Various of food	PV1.1	List menu
FR1.1.1	Increase power	DP1.1.1	Various of staple food	PV1.1.1	The staple food of the majority of Indonesians
FR1.1.1.1	Provide high carbohydrate	DP1.1.1.1	Rice	PV1.1.1.1	Using the best quality rice (fragrant pandanus, setra ramos, rojolele, IR 42, or C4 rice)
FR1.1.2	Provide complementary of staple food	DP1.1.2	Types of side dishes	PV1.1.2	Using the inexpensive basic ingredients (meat) and vegetable
FR1.1.2.1	Meet the needs of animal protein	DP1.1.2.1	Processed chicken	PV1.1.2.1	Using Broiler Chickens
FR1.1.2.1.1	Provide the taste of crunchy	DP1.1.2.1.1	Fried chicken		
FR1.1.2.1.2	Reduce fat	DP1.1.2.1.2	Grilled chicken		
FR1.1.2.1.3	Provide the tasteful on a gravy dish	DP1.1.2.1.3	Rica - rica of chicken		
FR1.1.2.1.4	Provide a gravy with a sweet and savory spicy flavor	DP1.1.2.1.4	Tongseng Ayam		

Code	Functional Requirements	Code	Design Parameters	Code	Variabel Process
FR1.1.2.1.5	Provide savory gravy	DP1.1.2.1.5	Gulai Ayam		
FR1.1.2.1.6	Provides a sweet spicy sensation	DP1.1.2.1.6	Chicken with sweet and spicy sauce		
FR1.1.2.1.7	Provides a tomato acid sensation	DP1.1.2.1.7	Chicken with the sauce of acid spicy		
FR1.1.2.1.8	Provides a warm sensation of black pepper	DP1.1.2.1.8	Chicken with black pepper sauce		
FR1.1.2.1.9	Gives a typical barbeque sensation	DP1.1.2.1.9	Chicken barbeque sauce		
FR1.1.2.1.10	Provides a distinctive spicy oyster sensation	DP1.1.2.1.10	Chicken Oyster Sauce		
FR1.1.2.1.11	Provides sweet and savory sensations of nuts	DP1.1.2.1.11	Chicken Sauce pecel		
FR1.1.2.1.12	Provides a fresh spicy sensation	DP1.1.2.1.12	Chicken with chili sauce of korek		
FR1.1.2.1.13	Provides a spicy sensation of shrimp paste	DP1.1.2.1.13	Chicken with chili and terasi sauce		
FR1.1.2.1.14	Provides the sensation of spicy of green chili	DP1.1.2.1.14	Chicken with green chili sauce		
FR1.1.2.1.15	Provides the sensation of spicy of red chili	DP1.1.2.1.15	Chicken with red chili sauce		
FR1.1.2.1.16	Provides a stinging spicy sensation	DP1.1.2.1.16	Chicken with “bledek”chili sauce		
FR1.1.2.1.17	Provides the sensation of spicy on *rujak*	DP1.1.2.1.17	Chicken with seasoning *rujak*		
FR1.1.2.1.18	Provides a sensation of spicy flavor teriyaki	DP1.1.2.1.18	Chicken with sauce of teriyaki		
FR1.1.2.2	Meet the needs of vitamins	DP1.1.2.2	Various processed vegetables	PV1.1.2.2	Processed vegetables of Javanese

Code	Functional Requirements	Code	Design Parameters	Code	Variabel Process
FR1.1.2.2.1	Add anti oxidants	DP1.1.2.2.1	Lalapan (traditional salad)		
FR1.1.2.2.2	Add iron	DP1.1.2.2.2	Watercress		
FR1.1.2.2.3	Add vitamin B	DP1.1.2.2.3	Trancam		
FR1.1.2.2.4	Provide Free Anti-Radical	DP1.1.2.2.4	Sayur Asem		
FR1.1.2.2.5	Lower cholesterol	DP1.1.2.2.5	Mushroom		
FR1.1.2.2.6	Improving Fertility	DP1.1.2.2.6	Bean sprout		
FR1.2	Provides a large selection of drinks	DP1.2	Various of beverage	PV1.2	Beverage with cheap raw materials and easy to make
FR1.2.1	Increase mineral	DP1.2.1	Mineral water	PV1.2.1	Water gallon refill
FR1.2.2	Anti aging	DP1.2.2	Drinking tea	PV1.2.2	Using tea of poci
FR1.2.2.1	Gives a cool sensation to tea	DP1.2.2.1	Ice tea		
FR1.2.2.2	Memberikan sensasi hangat pada teh	DP1.2.2.2	Hot tea		
FR1.2.3	Reduce hotness with orange juice	DP1.2.3	Orange	PV1.2.3	1 Portion using2 oranges
FR1.2.3.1	Gives a cool sensation to the squeezed oranges	DP1.2.3.1	Ice Orange		
FR1.2.3.2	Provides a warm sensation on the squeezed orange	DP1.2.3.2	hot/warm orange		
FR1.2.4	Adding vitamins with a refreshing fruit taste sensation	DP1.2.4	Fruit juice	PV1.2.4	Using local fruits
FR1.2.4.1	Lose weight	DP1.2.4.1	Honeydew juice		
FR1.2.4.2	Maintain health and beauty	DP1.2.4.2	Apple juice		

Code	Functional Requirements	Code	Design Parameters	Code	Variabel Process
FR1.2.4.3	Smooth digestion and fighting free radicals	DP1.2.4.3	Mango juice		
FR1.2.4.4	Maintain healthy skin	DP1.2.4.4	Guava juice		
FR1.2.4.5	Controlling sugar levels	DP1.2.4.5	Avocado juice		
FR1.2.4.6	Lower cholesterol and fight free radicals	DP1.2.4.6	Dragon fruit juice		
FR1.2.4.7	Reduce hot taste with the sensation of orange shake	DP1.2.4.7	Orange juice		
FR2	Build Customer trust	DP2	Management the small-scale restaurant	PV2	Small-scaleRestaurant Management System
FR2.1	Increase new customers	DP2.1	marketing of small scale restaurant	PV2.1	Marketing strategy
FR2.1.1	Introduce small-scale restaurant to new customers	DP2.1.1	Promotion method	PV2.1.1	20% discount on the first week of opening
FR2.2	Improve product quality	DP2.2	Product Quality Management	PV2.2	Food and beverage handling system
FR2.2.1	Maintain the consistency of taste	DP2.2.1	Standardization of Cooking Process (SOP)	PV2.2.1	Dosage of material and order of handling
FR2.3	Improving Service Quality	DP2.3	Quality management service	PV2.3	Customer service system
FR2.3.1	Meet orders quickly	DP2.3.1	Cooking methods	PV2.3.1	Ingredients prepared before the restaurant open and seasoning ready to cook (already milled)

Code	Functional Requirements	Code	Design Parameters	Code	Variabel Process
FR2.3.2	Give attention to the customers who come	DP2.3.2	Value Believe on Order Service	PV2.3.2	Every employee smiles, welcomes and greets to customers
FR2.3.3	Facilitate the customers to order food	DP2.3.3	System of order	PV2.3.3	The waiter goes the customer at the dinner table, gave the menu book and order note
FR2.3.3.1	Facilitate customers to choose food and beverage	DP2.3.3.1	Menu design	PV2.3.3.1	Complete information on the menu
FR2.3.3.1.1	Provide information of food and beverage menu	DP2.3.3.1.1	List of food and beverage	PV2.3.3.1.1	Writing the customer name and price of food below the menu picture
FR2.3.3.1.2	Provides an overview menu which want to be ordered	DP2.3.3.1.2	Picture of food on the menu	PV2.3.3.1.2	
FR2.3.3.1.3	Provide information of price	DP2.3.3.1.3	Price information on the menu	PV2.3.3.1.3	
FR2.3.3.2	Minimize Order Error	DP2.3.3.2	Order note	PV2.3.3.2	Contains the ordered menu, number, and table number
FR2.3.3.3	Minimize Order delivery errors	DP2.3.3.3	Table number	PV2.3.3.3	Put on the customer's desk
FR2.3.4	Provide a positive impression during Presentation	DP2.3.4	Method of Serving food		
FR2.3.4.1	Make eye catching food	DP2.3.4.1	Food Presentation Creation		
FR2.3.4.2	Make eye catching beverage	DP2.3.4.2	Food Presentation Creation		
FR2.3.5	Facilitate the payment	DP2.3.5	Method of payment	PV2.3.5	The customer pays the sand after the meal

Code	Functional Requirements	Code	Design Parameters	Code	Variabel Process
FR2.3.5.1	Improve the speed of payment service	DP2.3.5.1	Cashier machine facility	PV2.3.5.1	Casio cash register register (SE-G1)
FR2.3.5.2	Provide price transparency	DP2.3.5.2	Purchase order	PV2.3.5.2	The note from the cash register is given to the customer
FR3	Increase comfort in the small-scale restaurant	DP3	The design of the venue and facilities	PV3	The cost of procurement of venue and facilities does not exceed Rp. 50.000.000, -
FR3.1	Facilitate customers looking for a small-scale restaurant	FR3.1	Strategic location	FR3.1	Finding a location in the area of the target market
FR3.2	Eye catching for customers who pass by	FR3.2	Exterior design	FR3.2	Outlook of small-scale restaurant
FR3.2.1	Provide menu information and small-scale restaurant names	DP3.2.1	Design banner	PV3.2.1	Contains images, menu names, prices and promo provided by the small-scale restaurant
FR3.2.2	Make the restaurant look striking	DP3.2.2	The color of the wall is bright on the outside	PV3.2.2	Using the striking bright colors that characterize the small-scale restaurant
FR3.3	Provide comfort of the room	DP3.3	Interior Design	PV3.3	The look of Restaurant
FR3.3.1	Provide a cool impression on the room	DP3.3.1	Cool colors on the inner wall	PV3.3.1	Use a cool color
FR3.3.2	Provide description of menu to customers	DP3.3.2	The poster contains photos and names of foods on the wall inside the building	PV3.3.2	Photo arrangement of food and beverage on the wall

Code	Functional Requirements	Code	Design Parameters	Code	Variabel Process
FR3.4	Give needs other than food and beverage	DP3.4	Supporting facilities	PV3.4	The cost of supporting facilities does not exceed Rp. 10,000,000, -
FR3.4.1	Facilitate customers to park car/motorcycle	DP3.4.1	Parking lot for car and motorcycle	PV3.4.1	Enough for 2 cars and 10 motorcycles
FR3.4.2	Provide comfort when enjoying the dish	DP3.4.2	Ergonomic chair and table	PV3.4.2	Calculation of table and chair dimensions with anthropometry
FR3.4.3	Facilitate customers to clean hands	DP3.4.3	Sink	PV3.4.3	1 unit
FR3.4.4	Facilitate customers to defecate comfortably	DP3.4.4	Toilet	PV3.4.4	1 unit
FR3.4.5	Provide entertainment	DP3.4.5	Music/Live Music/TV	PV3.4.5	1 unit of speaker/TV
FR3.4.6	Facilitate customers to clean mouth after eating	DP3.4.6	Tissue	PV3.4.6	1 table, 1 container of tissue
FR3.4.7	cooling the restaurant temperature	DP3.4.7	Fan	PV3.4.7	2 unit of fans

Test Homogenity Results with Customer Demand Homogeneity

The result of homogeneity test is shown by table 5.

Table 5. Homogeneity Test Results with Customer Desire

The Concept of Small-scale Restaurant	*Sig, Value*	α
Design of food and beverages	0,622	0,05
Providing a variety of staple foods	0,138	0,05
Various kinds of side dishes	0,612	0,05
Various of beverages	0,899	0,05
Small-scale restaurant management	0.655	0.05
Creating promotion strategy	0.564	0.05
Method of procurement of raw Materials	0.23	0.05
Method of service	0.505	0.05

The Concept of Small-scale Restaurant	*Sig, Value*	α
Design of small-scale restaurant	0.07	0.05
Location election	0.763	0.05
Eye catching exterior design	0.07	0.05
Unique interior design of small-scale restaurant	0.059	0.05
Supporting facilities to ease employee movement	0.083	0.05

Table 6. The result of marginal homogeneity test is significance between 0.059 - 0.899. This means the null hypothesis is accepted because z> 0.05. Thus, the strategy of small-scale restaurant design is in accordance with user needs.

Design Model Concept of Small-Scale Restaurant Business Strategy Based on Axiomatic Design

Based on data processing with axiomatic design method can be determined the business strategy models that must be conducted when build a new business. That can be described as follows:

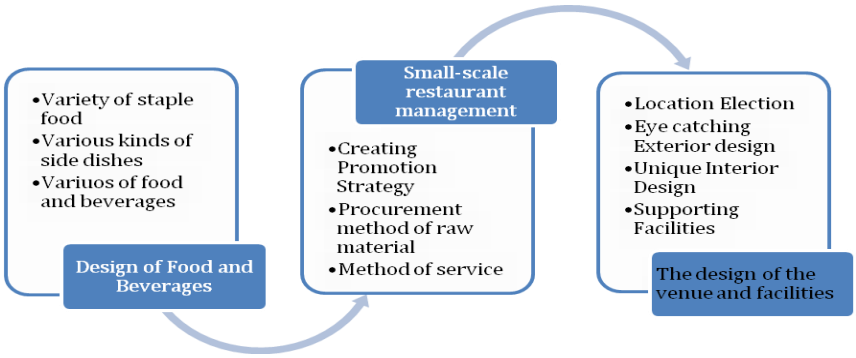

Figure 3. Designing Model of Small-scale Restaurant Business Strategy

The model in Figure 4 shows the model of restaurant designing a business strategy based on the results of the research. To produce the concept of a small-scale restaurant that can compete with other companies, entrepreneurs should pay attention with every point that is on the model shown Figure 4. Verification test result shows the value of agreed / important proportion (> 3) on each variable> of the value of disagree / unimportant proportion (<= 3) with the significance value of each variable> 0.05. This means that it can be concluded that the result can be used for restaurant strategy design.

CONCLUSION

The business strategy model proposed encompasses three strategies. They are a strategy to design various food and beverages products includes types of staple food, variations of side dishes and beverage; a strategy to develop an effective business management in restaurant which consists of marketing management, product quality management and service quality management; a strategy to design of a comfortable place and facility that consists of determining the strategic location, the concept of exterior and interior design, and provide supporting facilities which is needed by customers when use take away service.

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BUSINESS ANALYSIS AND STRATEGY THE DEVELOPMENT OF PASUNDAN CATTLE IN WEST JAVA

[1*)] Linda Herlina, [2)] Maman Paturochman, [3)] Achmad Firman, [4)] Marina Sulistyati,

[5)] Anita Fitriani

[1)] Faculty Animal Husbandry of Padjadjaran University

[*)] Correspondence e-mail : linda.herlina@unpad.ac.id

Abstract

Research on Business Analysis and strategy of development of Pasundan Cattle in West Java have been implemented on farms in West Java which is engaged in the business of Pasundan Cattle in September 2016 until December 2016. This research aims to know the size of the BEP, efficiency and strategy of business development pasundan cattle. This study used a survey method with data collection using a system of interviews and sampling techniques using a simple random sampling method. The results of this research show that the magnitude of BEP production pasundan cattle 4.46 AU, BEP price IDR 58.628,87/AU and the value of R/C Ratio 1.27. The results of internal and external matrix, attempts a pasundan cattle was at quadrant II, therefore should use diversification strategy. With regard to enterprise development are encouraged to cooperate with the Government, so the Government can pay attention to and join in supporting the needs of ranchers in the problems of capital and infrastructure businesses.

Keywords : Business Analysis, strategy development, pasundan cattle

INTRODUCTION

Efforts to meet the needs of meat in West Java, is there must be increased self-reliance in the supply of meat. One of these efforts is to optimize the potential of local cattle, in this case is pasundan beef cattle. The name of the family pasundan cattlehas been established based on the decision of the Minister of Agriculture of the Republic of Indonesia Number 1051/Kpts/SR 120/10/2014 (the Ministry of Agriculture of the Republic of Indonesia, 2014). As for the traits of beef, among others, the fleece color pasundan Sorrel (for females) and black (for a male), the horns are short and small, and has a line of black eel on the back. Although productivity pasundan cattle lower than on cattle imports, but pasundan cattle has many advantages. From then on, among others, is has a high adaptation power against low-quality feed, relatively resistant to disease and have a pretty good reproduction performance that is capable of producing a childevery year.

With respect to the opportunities, need to be analyzed and pasundan cattlebusinesses are expected to provide information to farmers about the benefits obtained, should be also seen further development strategies of the cattle business. Because this information is still very limited and require further studies, then it has been taken a research on Business Analysis and strategy of development of Pasundan cattlein West Java.

The purposes of this research are (1). Analyze business condition of pasundan cattle by size and income level BEP; (2) Analyze strategies business development in the area of pasundan cattle research.

This research may (1) provide information to breeders in order to increase production by way of doing the repairs against the constraints that exist ; (2) providing information to local governments or relevant parties for policy in the development pasundan beef cattle.

RESEARCH METHOD

Materials and Methods

The research object of business is pasundan cattle. The research method used was a survey at a location central to the spread of pasundan beef cattle, namely in the area of brass, Majalengka, Garut, Sukabumi and Cianjur with type a descriptive quantitative research. Descriptive survey method is a method of research that takes samples from a population with the interview as a means of collecting data to be processed and the results are then further described in descriptive. Respondents are breeders who keep pasundan cattlevariables used include acceptance of livestock business, the cost of production, income and efficiency efforts and the Break Even Point (BEP).

Methods Of Analysis

1. Efficiency of the usaha ; use a R – C ratio or revenue cost ratio, is the comparison between acceptance by the expenditure (Hernanto, 1993)

$$R/C = \frac{TR}{TC}$$

As for the criteria as follows:
R/C > 1 Efficient
R/C = 1 break even
R/C < 1 Inefficient

2. Break Event Point (BEP) refers to a situation where in its operation, the company does not earn a profit and does not suffer a loss or in other words the same acceptance and costs (TR = TC), Riyanto (2001)

   a. Calculation of the Break Event Point on the basis of the Unit

$$BEP\ (Q) = \frac{FC}{P - VC}$$

Description : BEP (Q) : the number of units produced and sold (Kg)
Q : the selling price per unit
VC : Variable Cost per unit
FC : Fixed Cost

   b. calculation of the Break Event Point on the basis of sales in Rupiahs

$$BEP(P) = \frac{FC}{1 - \frac{VC}{S}}$$

Description : BEP (P) : The Volume Of Sales
VC : Variable Cost per unit
FC : Fixed Cost
S : Sales Volume

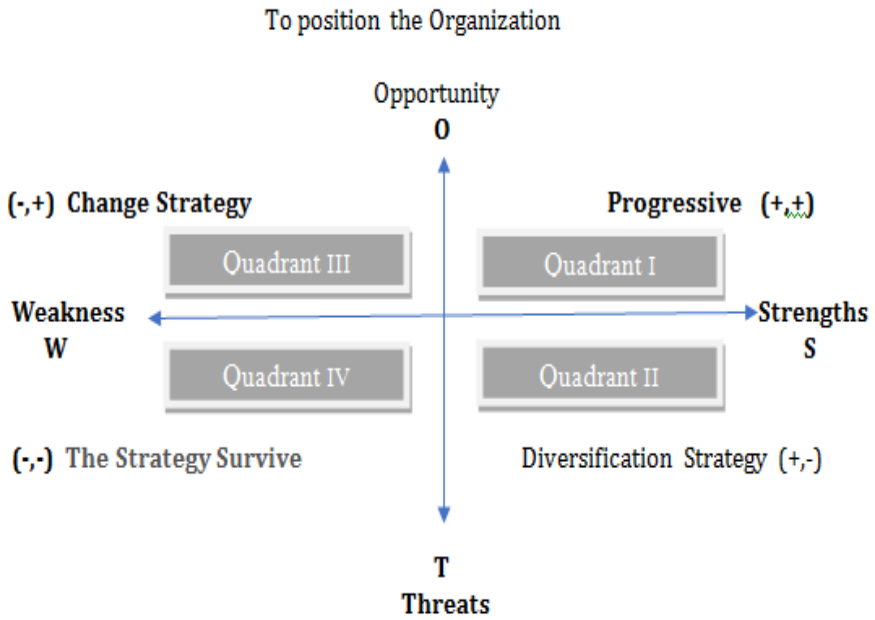
3. SWOT Analysis

Approaching SWOT analysis was used for the determination of the business development strategy, according to Rangkuti (2006) to formulate a strategy to do the formulation

of external and internal factors (External and Internal Factory Analysis Summary Factory Analysis) and through the SWOT analysis matrix model approach. Namely are SO strategy, ST strategies, WO strategies, and WT strategies. The analysis of matriknya as follows:

IFAS EFAS	STRENGTHS (S)	WEAKNESS (W)
OPPORTUNITIES (O)	STRATEGIES SO	STRATEGIES WO
THREATS (T)	STRATEGIES ST	STRATEGIES WT

Illustrations 1. SWOT Analysis (Rangkuti, 2006)



Illustrations 2. Diagram analysis of SWOT (Rangkuti, 2006)

RESULTS AND DISCUSSION

Pasundan cattle business which is in West Java is a side job business generally, but nevertheless this effort can be said to be or become an additional source of income for breeders. It is said so because the contribution of effort it can pasundan cattle felt by ranchers in meeting some of the needs of families among them for the cost of education, prenatal family, home renovations and purchasing means of transport.

In general maintenancee of the pasundan cattle equals maintenance other beef cattle livestock, among which include the search feed, feeding, cleaning cages, and treatment of disease or health. Cage used in General simple colony cages and relatively uniform. This type of feed is the main form of forage or straw rice. The awarding of the bran is usually only under certain circumstances (not

every day). Based on previous research (Herlina, 2017) reveals that the fresh forage for feeding as many as 15 kg/ST/day and for an extra form feed needs as much bran 0.99 kg/ST/day, it shows the feed provided does not correspond to the needs of his life. It is not in line with the opinion of Sugeng (2000) that the principal feed on beef cattle forage be is or grass and feed the amplifier in addition, generally forage feed is given in the amount of 10% of body weight and feed the amplifier is quite 1% of body weight.

Research results Herlina (2017) suggests that with an average ownership of 5.64 ST, earned an average income of Rp. 1.160.588,56/ST/year. Pasundan cattle business has been streamlined, with the level of efficiency of 1.33. Number of owned have important means for farm run because it affects the earned income. In line with research Saleh dkk (2006) concerning the analysis of the Revenue Farm beef cattle in Kecamatan Hamparan Perak, Deli Serdang Regency, is for each addition of 1 ST cattle ranchers and income will increase this effect very real results against the income of dairy farmers in maintaining beef cattle.

Business Analysis used in this study was the Break Event Point (BEP) which is based on the cattle business planning costs and sales. Based on the results of the analysis show that the effort is good for pasundan cattle was carried out because the sale price is greater than the volume of production and price of BEP is also greater than the volume of cows are kept. Break Event Point production obtained is 4.46 AU with BEP price is Rp 58.628,87/Kg.

In addition to the analysis of the BEP also conducted an analysis of R/C Ratio is a comparison between the total acceptance by the total fees incurred. The results of the R/C Ratio is 1.27. It has the sense that each increment costs Rp. 100,-, will result in acceptance as much as Rp. 127,-. The higher value of R/C shows the more profitable, and from the results of the calculations that the R/C > 1 meaning Pasundan cattle already efficiently.

Drafting of development strategies is done with the SWOT analysis against various internal and external factors of pasundan cattle in West Java. Internal factors identified as strengths and weaknesses and external factors identified as opportunities and threats in the effort. Based on the results of the identification of internal factors and external factors are rating and weighting is performed to obtain a score for each of the factors that have been identified. The results of the matrix can be seen in table 1 and table 2.

For the formulation of strategies, as seen from a combination of factors-both internal and external factors that have been analyzed as in table 1 and 2, it is used to formulate enterprise development strategies pasundan cattle. Based on the results of subsequent SWOT mapping formulated several strategies, it can be seen in table 3.

Comparison matrix based on internal and external factors, pasundan cattle was at quadrant II, i.e. diversification strategy. The position of diversification strategy, this means that the organization is in good condition but facing a number of challenges which are quite heavy so the estimated operations of the Organization will have difficulty in his business when only relying on previous strategies, it is therefore advisable to reproduce organizational diversity strategy.

Views of the strength of the resource in the form of land, labor and market opportunities have the potential for business development. With regard to enterprise development are encouraged to cooperate with the Government, so the Government can pay attention to and join in supporting the needs of ranchers in the problems of capital and infrastructure businesses.

Table 1. The Internal Factor Evaluation (IFE) Business Pasundan Cattle

No.	Strength	Weighted	Rating	Score
1	The majority of the population of Cows	0.055	2.35	0.129
2	Support the climate against the availability of forage	0.062	2	0.124
3	Some Excellence Pasundan Cattle	0.065	3	0.195
4	Experience Raising	0.066	3	0.198
5	Business Continuity	0.058	2.45	0.142
6	Availability of Labor on household	0.057	2.55	0.145
7	Availability of Enough land	0.063	2.45	0.140
8	Ease of livestock marketing mechanism	0.057	2.45	0.140
9	Farm infrastructure Support	0.058	2	0.116
	The number	0.541		1.363

	Weakness	Weighted	Rating	Score
1	Population growth low female parent	0.048	3	0.144
2	Low armers Education	0.051	3	0.153
3	Rancher lacking understanding health cattle	0.043	3	0.129
4	Is a side job business Pasundan cattle	0.052	3	0.156
5	Ownership cattle still low	0.048	2.5	0.120
6	The presence of beef price fluctuations	0.057	3.2	0.182
7	Limitations of venture capital livestock	0.058	2.1	0.122
8	Lack of extension	0.041	2	0.082
9	Turnaround capital slow	0.061	2.9	0.177
	The number	0.459		1.265
	The total number of IFE	**1**		

Table 2. External Factor Evaluation (EFE) Business Pasundan Cattle

No	Opportunity	Weighted	Rating	Score
1	Demand for beef cattle is increasing	0.075	3.50	0.263
2	High economic value	0.069	2.95	0.204
3	Diet community will Meat	0.058	2,.00	0.116
4	The existence of the animal markets	0.039	2.25	0.088
5	The existence of a program of non government organisations meat	0.061	2.15	0.131
6	Technology IB Pasundan Cattle in society	0.044	1.75	0.077
7	Ease of obtaining feed forage	0.068	2.45	0.167
8	Employment Farmers	0.047	2.25	0.106
9	The growing popularity of the use of organic fertilizer	0.048	1.95	0,094
10	Animal health officer of the existence	0.051	1.85	0.094
	The number	0.56		1.338

	The Threat	Weighted	Rating	Score
1	The price of the means of production on the rise	0.059	2.55	0.150
2	Rivalry with other businesses	0.042	3.50	0.147
3	The presence of meat import policy	0.037	3.15	0.117
4	The existence of land over the function	0.033	3.00	0.099
5	Weak institutional farmer rancher	0.041	3.00	0.123
6	Population	0.041	3.30	0.135
7	Maintenance the Pattern still traditional	0.049	3.15	0.154
8	Security environment	0.053	2.65	0.140
9	Existence of infectious diseases	0.039	2.85	0.111
10	Lack of livestock health extension officers officer	0.046	2.95	0.136
	The number	0.440		1.313
	The total number of EFE	**1**		

Tabel 3. Matriks Mapping Result Some Strategies SWOT

Internal (IFE) / Eksternal (EFE)	STRENGTHS (S)	WEAKNESS (W)
	1. The majority of the population of Pasundan cattle 2. Support the climate against the availability of forage 3. Several advantages of pasundan cattle 4. The experience of raising 5. Business Continuity 6. Availability of labor on household farmers 7. Sufficient availability of land 8. Ease of livestock marketing Mechanism 9. The livestock business infrastructure Support	1. Population growth low female parent 2. Low productivity 3. Low farmers education 4. The rancher lacking understanding the health of cattle 5. Business is a side job business of pasundan cattle 6. Cattle Ownership still low 7. The existence of price fluctuations of cattle 8. Limitations of capital stock of livestock. 9. Lack of extension 10. Slow capital Turnover
OPPORTUNITY	STRATEGY SO	STRATEGY WO
1. Increased demand for beef cattle 2. High economic value. 3. Eating patterns community will meat. 4. The existence of the animal markets 5. The existence of a program of non government organisations meat 6. Technology of the IB community in pasundan cattle 7. Base of obtaining feed forage 8. The breeder job opportunities 9. The growing popularity of	Make use of the available resources in enhancing the efforts of pasundan cattle	- Educate farmers about breeding true science accompanied by demonstration - Optimize beef self-sufficiency programs

the use of organic fertilizer 10. The presence of animal health officer		
THREATS (T)	STRATEGY ST	STRATEGY WT
1. The prices of means of production on the rise 2. Competition with other businesses 3. The existence of a policy on meat imports 4. The presence of land over the function 5. Weak institutional farmer rancher 6. Population 7. Maintenance the Pattern still traditional 8. Security environment 9. The presence of an infectious disease 10. Lack of livestock health extension officers.	Increased skills of farmers and extension officers in improving livestock business	In cooperation with the Government so that the Government can pay attention to and join in supporting the needs of ranchers in terms of capital and infrastructure.

As for programs that can be carried out regarding the cooperation with the Government is :

1. Institutional Strengthening, in this case to build a system of market information on price, supply and demand so that breeders can increase the effort.
2. Extension, by enabling the officers trained extension officers and health.
3. Improvements to the infrastructure, in this case (a) facilitate the availability of means of production such as the development Hall of artificial insemination to produce frozen semen pasundan cattle, repair quality of feed, the procurement of drugs, vaccines and animal husbandry equipment in quantities sufficient to the level of quality and affordable prices; (b) the manufacture of compost/manure solid livestock waste to capitalize on being an environmentally friendly source of energy.
4. Facilitate the provision of funds to take care of the credit guarantee of fanciers so independent in his efforts.

CONCLUSION

Based on the results of research that has been done, the conclusion that:

1. Pasundan cattle venture is better to be implemented because the sale price is greater than the volume of production and price of BEP is also greater than the volume of cattle are kept. Break Event Point production obtained i.e. 4.46 AU with BEP price is Rp 58.628,87/Kg. The value of R/C Ratio i.e. of 1.27. It has the sense that each increment costs Rp. 100,-, will result in acceptance as much as Rp. 127,-. The higher value of R/C shows more profitable, and from the results of the calculations that the R/C > 1 meaning Pasundan cattle venture already efficiently.
2. The results of the external and internal matrix, attempts a pasundan cattle was at quadrant II, therefore should use diversification strategy. With regard to enterprise development are encouraged to cooperate with the Government, so the Government can pay attention to and join in supporting the needs of ranchers in the problems of capital and infrastructure businesses.

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AN ANALYSIS OF THE EFFECT OF THE DIFFERENT SYSTEMS OF RUBBER (*Hevea brasiliensis*) MARKETING BETWEEN THE AUCTION MARKETING SYSTEM AND THE FREE MARKET SYSTEM ON THE INCOME OF THE FARMERS AT VILLAGE UNIT COOPERATIVE OF SERASAN JAYA MUARA ENIM REGENCY

Kuswantinah

Agribusiness Study Program of Faculty of Agriculture, Sjakhyakirti University

Correspondence e-mail : kuswantinah56@gmail.com

Abstract

An Analysis of the Effect of the Different Systems of Rubber (*Hevea brasiliensis L.*) Marketing between the Auction Marketing System and the Free Market System on the Income of the Farmers at Village Unit Cooperative (*KUD*) of Serasan Jaya in the Subdistrict of Gelumbang, Muara Enim Regency.The objective of this study is to disclose the amount of income obtained by the farmers who market their rubber with the auction market system in comparison with that obtained by the farmers who market their rubber with the free market system and the amount of their income difference.The study was conducted in *KUD* Serasan Jaya, Gelumbang Subdistrict, Muara Enim Regency, South Sumatera Province. The study was conducted from November 2015 to March 2016. The method used in this study was the survey method on the 10 sample rubber farmers from each group.The results of the study showed that the average production of the farmers who market their product with the auction market system was 100,850 kg / 6 months with the rubber price of Rp. 8,660.53 / kg. The income of the farmers who marketed their rubber with the auction market system was Rp. 85,143,523.00 / 6 months.The average production of the rubber farmers who marketed their product with the free market system was 98,310 kg / 6 months. The price of the rubber was Rp. 8,017.78 / kg. The average income of the farmers who marketed their rubber with the free market system was Rp. 77,678,386.10 / 6 months.The results of the calculation of the value of t count for the production that was sold through the auction market system was 3,003 greater than the value of t table (α = 1%) = 2.896 or 3.003 > 2.896, meaning that there was a difference in income between the farmers who sold their rubber with the auction marketing system and the farmers who sold their rubber with the free market system.

Keywords : rubber, auction marketing system, free marketing system

INTRODUCTION

Rubber plants (Hevea brasiliensis Muel Arg.) have a very important role in the national economy, among others as a source of income of 10 million farmers and absorb about 1.70 million workers, and contribute to Gross Domestic Product (GDP) with the amount of Rp. 6 trillion annually (Anonymous, 2007 and Setyatmaja, 2010)

The National Rubber Development Plan, directed to the national rubber development policy in the long run is a rubber agribusiness based on latex and wood that has high competitiveness, that make the farmers prosper, environmental friendly and sustainably sound (South Sumatra Provincial Government, 2006)

By 2025 it is expected that Indonesia will become the largest producer of natural rubber (3-4 million tons per year) and as the world's leading producer of natural rubber based products with an indicator of domestic natural rubber absorption rate reaching at least 25% (Directorate General of Plantation Production Development, 2011).

According to the Plantation Office of South Sumatra Province (2010), South Sumatra Province is one of the largest rubber producing regions in Indonesia with a total area reaching 955,617 hectares

consisting of 899,467 hectares of people's plantation, and 56,150 hectares of state plantation with the productivity reaching 670,052 tonnes per hectare per year of people's plantation, and 680,362 tonnes per hectare per year of state plantations. (Office of Plantation of South Sumatra Province, 2015).

One of the regencies of South Sumatera Province that has considerable potential in developing people's rubber plantation is Muara Enim Regency. The interest of Muara Enim citizens in planting rubber is very high. This is reflected by the extent of rubber plantion cultivated by the people of Muara Enim. In 2013 the area of the rubber plantation in South Sumatra reached more than 1.2 million hectares, almost entirely or about 94% of which are people's rubber plantation. Based on the description above, the problems of the study are formulated as follows :

1. How does the mechanism of rubber marketing with the auction system and the free market system operate;
2. What are the cost of production, the prices, and the revenue of the rubber farmers who market their rubber with the auction marketing system and those of the farmers who use the free market system?

Is there a difference in income between the farmers who market their rubber with the auction system and the income of the farmers who sell their rubber with the free market system.
The study was conducted in VCU of Serasan Jaya, Gelumbang Subdistrict, Muara Enim Regency, South Sumatera Province. The determination of location is done purposively with a consideration that the area is a rubber marketing center with the auction market system and the free market system. The study was conducted from November 2015 to March 2016.

RESEARCH METHODS

The research method used in this study is a survey method. The sampling method used is the Stratified Random Samplng, with the number of samples of 10 farmers each). The data are descriptively analyzed and followed by a parametric statistical test of a median difference test (t test) (Moh. Nazir, 2005)

RESULT AND DISCUSSION

The mechanism of rubber marketing with the auction market system begins with the registration of Village Cooperative Unit (VCU) members who will join the rubber auction directed by the head of the RCS (Rubber Collection Site), and informs the auction committee on the amount of tonnage of rubber of each RCS that will be sold. Each buyer at the VCU will propose a different price. The partner who gives the highest bid will be the winner of the auction. Then, the rubber is weighed at the village of RCS where the winner wins the aution and then the rubber is loaded in a truck that has been prepared by the partners. The weighing process is done by the partner who is accompanied by the chairman of the RCS. After that, the payment is made by the head of the RCS as the representative of the partners and the VCU.

In the marketing of free market system, the middleman comes directly to each farmer's plantation location and bargaining occurs, until the price is agreed which is an agreement between the farmers and the middlemen (Safuddin, 2000).

The result of the study shows that in general there are more farmers who market their rubber with the auction market system than those who market their rubber with the free market system. The price is also higher with auction market system, because Village Cooperative Unit (VCU) gives the seller requirements on the quality of rubber which includes cleanliness, rubber content, Whereas in the marketing of rubber with the free market system, there is not any specified requirement. Usually the middleman directly come to the farmers' plantation location and a transaction occurs and ultimately the price agreement is determined.

The average production of the farmers who market their rubber with the auction market system is 100,850 kg / 6 months. The price of the rubber is Rp. 8,660.53 / kg. The average income of the farmers who market their rubber with the auction market system is Rp. 85,143,523.00 / 6 months. While the average production of the farmers who sell their rubber with free market system is 98,310 kg / 6 months, rubber price is Rp. 8,017.78 / kg and the farmers' income is Rp.77,678,386.10 / 6 months.

The farmers' rubber is generally in the form of clot of frozen rubber which is frozen with recommended freezer (formic acid), or not recommended (vinegar, alum, etc.), as well as natural freezing (Amypalupy, 2002)

The marketing process needs cost, and this cost grows with the development of agriculture and the increasing complexity of marketing. The consumers whose economic level is increasingly higher, their prosperity demands agricultural products that are more diverse and increasingly complex management process, so that marketing system services are more abundant (Azaino, 2000).

In marketing rubber with the auction system through Village Cooperative Unit (VCU) of Serasan Jaya in Gelumbang Subdistrict, farmers do not spend their marketing cost, because the farmers' rubber are directly weighed at *TPK*, and all costs are borne by the buyer (Anonymous, 2005 and Directorate General of Plantation, 2011)

The Implementation of the auction system marketing in South Sumatra faces many obstacles such as :

a) the location of the farmers' rubber plantation which spreads, so there are about 15 auction markets reaching about 186 villages,
b) The farmers' dependence on the auction brokers c) And rubber prices in the village which are competitive enough. (Anonymous, 2003 and Syaefuddin, 2000).

The prices of rubber are also determined by 1) the type and quality of rubber; 2) dry rubber content (DRC); 3) the price of natural rubber from the aspects of cleanliness, storage, place of freezing, type of freezer, and world rubber price; and 4) marketing margins of rubber thickness. (Anonymous, 2003 and Amypalupy, 2002)

To disclose the difference of income between the farmers who sell their rubber with the auction market system and those who sell their rubber with free market system, an analysis is done by using the median difference test (t test) in which the t value for income is 3,620 bigger than t table value of (α = 1%) = 2,896 or 3,620 > 2,896, meaning that H0 is refused which means that there is a significant difference between the income of the farmers who sell their rubber with the auction market system and the farmers who sell their rubber with the free market system.

CONCLUSIONS AND SUGGESTIONS

Conclusion

1 There is a difference in the sales mechanism between the farmers selling their rubber with the auction market system and those who sell their rubber with the free market system.
2 The revenue obtained by the farmers who market their rubber with auction system is Rp. 85,143,523.00 per 6 months, while the revenue obtained by the farmers who market their rubber in the free market is Rp. 77.678.386,10 / 6 months
3 There is a difference in income between the sample farmers who market their rubber at Rubber Auction Places (RAP) which is greater than the income of the sample farmers who sell their rubber in the free market. It is proved by the statistical test that results in tcount > ttab (3.003>2.896) at the level of trust of ( ) 0,01

Suggestions

Based on the results and the conclusions of the of research, it is suggested that :

1. Rubber farmers in Gelumbang Subdistrict sell their rubber through the auction market so they will have a stronger bargaining power even though the price of the commodity is falling.
2. The quality of the farmers' rubber be improved by improving the cleanliness of the rubber processing materials, dry rubber content and others.

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SHALLOT AGRIBUSINESS DEVELOPMENT IN THE HIGHLAND OF MAJALENGKA REGENCY

Sri Ayu Andayani

Faculty of Agriculture, University of Majalengka

Correspondence e-mail : sri.ayuandayani@yahoo.com

Abstract

Shallot is one of the commodities that has a high economic value and potentially increases farmers' income. Nevertheless, a problem faced by shallot agribusiness is the production fluctuation. One of the shallot development areas in West Java is Majalengka regency, especially in the highlands part. This research provides an overview of shallot agribusiness in highland area, explores the problems that cause the fluctuation of production, and offers a range of solutions as the formulation of input from the actors and stakeholders in shaping systemic linkages. This study uses a system thinking approach of soft system methodology. The result shows that shallot agribusiness in the highland area is still not optimal. There are no synergies among actors involved in the realization of better shallot agribusiness to produce sustainability of production. Therefore, it requires the strengthening institutions which can facilitate the needs of farmers in establishing stronger agribusiness as well as a strong coordination among relevant actors both primary and supporting actors in shallot agribusiness.

Keywords : shallot, agribusiness, production fluctuations, SSM

INTRODUCTION

Shallot is a plant considered seasonal due to its peak production which occurs in certain months. Based on the recent phenomenon, shallot consumption is constantly increasing. The demand for shallot tends to increase, especially during religious holidays. These conditions resulted in a surging price when demand for shallot is higher than its unguaranteed stability supply. The differences in patterns of production and market demand for shallot will cause price volatility at a certain time (RPJM, 2014)

Production of shallot is still considered slowing so that it fails to meet growing consumer demand and cause price fluctuations. As it was seen in May 2016, shallot price was still around 20,000, rupiahs - per kg and increased by two times to Rp.36.000, - and 40,000, - per kg.

Bank Indonesia of Cirebon initiated to develop clusters of red shallot in addressing the phenomenon that occurs in several production centers in West Java. Porter (2000) explains that the cluster is the concept of a "geographic concentration which connecting the various businesses, suppliers, services, supporting industries, and institutions involved (universities, standards institutes, trade associations) in a particular field to be mutually cooperated and competed". By applying the concept of agribusiness cluster, it is expected to create value added in agribusiness management through engineering of shallot farmer groups.

However, the cluster development of shallot still has problems which until now have not been resolved yet. Shallot farmers are still not able to produce their product continuity and do not have strong institutions that can sustain their farm. This results in the low collaboration among actors, the absence of added value, and low productivity causes for limited product marketing of local market only. Those phenomena raise questions for this research, especially in the highland area of shallot development, which is what the detailed problems in the shallot supply chain and how the performance of each element which systemically shapes the association.

RESEARCH METHODS

The Soft System Methodology (SSM) approach can be used to identify interactions among shallot agribusiness actors. SSM approach has been widely used in various fields, for example in the areas of health, information systems, human resource management, and logistics system (Maqsood et al, 2011). SSM models of seven stages performing in this research are: (1) study the unstructured problems (rich picture); (2) describe the state of the problem (cultural analysis); (3) develop problems associated with problem situations through CATWOE; (4) build conceptual models (Human Activity System); (5) create a comparison of conceptual model with the problem situation; (6) determine feasible and desirable changes; (7) provide corrective actions of issues (Checkland & Scholes, 1990). As it is shown in Figure 1.

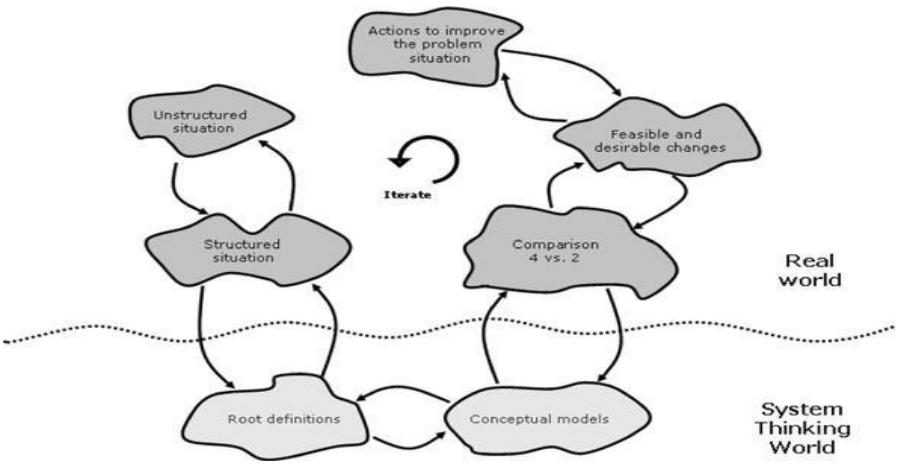

Figure 1. SSM Stages
Source: Checkland & Scholes (1990)

RESULTS AND DISCUSSION

Shallot Cultivation in Majalengka

Majalengka is one of the locations of shallot agribusiness development takes place in the highland with an altitude of 800-1000 meters above sea level, precisely in the area of Argapura. Shallot agribusiness starts from support industry of input provider, that is shallot seed breeder done by farmers or purchased from agricultural supply stores.

Actors involved in the supply chain of shallot in the highland area are farmers, farmer groups, the wholesalers, the traditional local market traders, markets outside the region. The yields in this area consist of shallot for consumption and shallot seeds. Shallot for consumption is marketing to the local market of Maja, either directly by farmers or farmer groups and the wholesalers. Shallots which are marketed through the wholesalers is widely performed for around 80 percent due to the cash payment. Rejected shallots is a risk borne by the wholesalers or farmers and farmers' group because of the low-quality product which fails to meet consumers' satisfaction.

Soft Systems Methodology

Actual condition

Issues that are considered complex faced by agribusiness supply chain is the weak collaboration and coordination among actors along the shallot supply chain. This further confirms the

fact that the shallot development is not optimal with the production discontinuity and mixed quality products which give impact on low productivity with no added value.

Shallot marketing has not been optimally conditioned with the markets in a partnership form. Farmer groups as supporting institutions are only limited to provide the means of production and shallot post-harvest collection. The once existed cooperatives has not yet shown their support, even today they considered vacuum to carry out their activities. Capitalization is still lacking but farmers seem to be reluctant to relate to financial institutions as capital providers.

Rich Picture

The picture of rich picture below is intended to explain the condition and situation of the problem from different angles or perspectives so as to be an emphasis on structure, processes, relationships, conflicts, and values. These conditions can be visualized by means of symbols that can be understood.

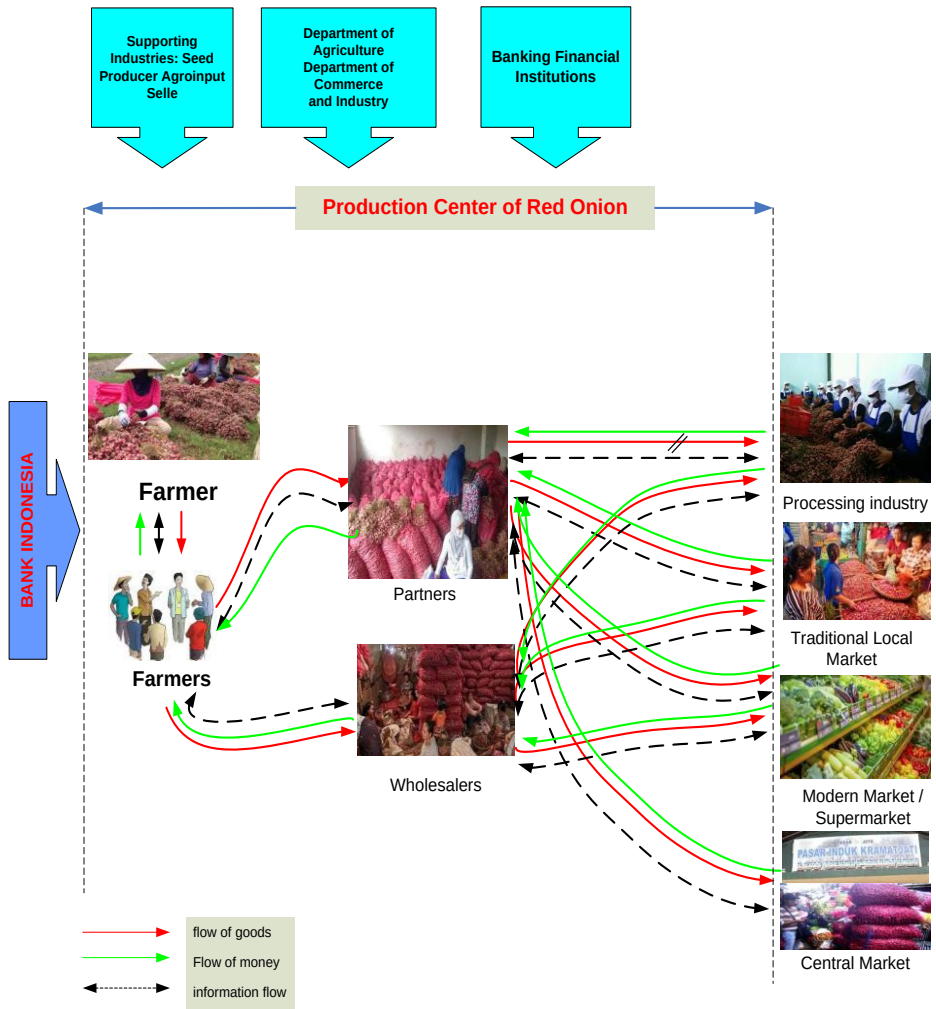

Figure 2. Rich Picture of Shallot Agribusiness

CATWOE Analysis Based on Transformation

Problems in the supply chain operation of shallot agribusiness can be studied and analyzed through CATWOE analysis in making the transformation events by means of dialogue and direct observation in the field, which then can be identified the structures and roles, the relationship between the role of the parties concerned, values, and norms (Checkland and Scholes, 1990). The shallot cultivation in the study site has not demonstrated an optimal development yet. Cultivation techniques have not met the Standard Operating Procedure (SOP), post-harvest processing in drying and warehousing is done in a simple/traditional way, a long marketing chain, and the unsustainability of shallot production. Overviewing these conditions, it is necessary to take the sustainable development in shallot agribusiness.

T: To increase the shallot farmers income through the optimal development of agribusiness in the production sustainability, so that by viewing the root of the problem in the operation of the shallot supply chain, a CATWOE analysis can be done as follows:

- *Customer :* C (beneficiaries) : the farmers of shallot
- *Actors :* A (actors who do the transformation) : group of farmers, the farmers of shallot
- *Transformation :* T (changes) : to increase farmers' income through the sustainable production of shallot
- *Weltanschauung :* W (meaningful perspective) : *multistakeholder* collaboration to support the development of shallot supply chain sustainability in production so that there is hope of increased incomes for shallot farmers.
- *Owners :* O (the parties may terminate the process of transformation /user) : group of farmers, the farmers of shallot
- *Environmental :* E (environmental constraints) : abilities and skills of shallot farmers, climate anomalies, existing cultures, information access and application of technology.

Based on CATWOE results analysis, a study is conducted to yield a formula to make changes by comparing the model with actual real-world that occurs in the field.

Observing the phenomenon and problems exist in the highland area of Majalengka Regency and based on CATWOE analysis, a detailed description of the problems can be seen in table 1 below.

Table 1. Actual Condition

Process of activities in the supply chain of shallot agribusiness	Actual Condition in the supply chain of shallot agribusiness
The implementation of shallot cultivation	Frequent delays in planting schedules, the risk of crop failure, the uncertainty of seed supply due to the expensive price and even fluctuated
Event of harvest and post-harvest	The drying process is still done manually/traditionally with a modest warehouse conditions and many tebasan systems (a system which gives no benefit to farmers), and high level of shallot shrinkage.
Sorting	It is done by farmer groups and wholesalers and there is no shallot grade and standard.
Capital	It still not involve financial institutions such as banks and only rely on loans to traders or wholesalers if they need additional capital for the business

The Partnership	It still has a contract with the Ministry of Agriculture since 2015 but only limited for the independent farmer in the village of Sukasari, while the partnership with industry has never been established before.
Farmer groups	It does not yet play a role as it should be as a medium of information and communication, coaching media, consulting and marketing. The role of farmer groups is a place to collect shallot from farmers after harvesting
Pricing	There is no certainty on sales price of shallot
production continuity	It is not assured yet

Demand for shallot in the last few years has continued to increase, while the production has been delayed so that the supply of shallot is reduced and can not meet the consumer demand. This condition raises the issue of dynamic supply chain. The supply chain can be regarded as a system and have elements such as described by Chopra and Meindl (2007) that the supply chain is all the activities that have orientation on fulfilling the wishes and needs of consumers. By looking at the actual condition above, it can be said that the shallot agribusiness supply chain in Majalengka still can not meet the desires and needs of consumers.

Cultural analysis

Checkland and Scholes, 1990, describes in the cultural analysis that the assessment need interventions which can be regarded as a problem and their identifications are: the intervention of structure and roles and viewing the relationship from that values, norms, and roles. Structure and roles of shallot agribusiness chain supply can be seen as follows :

Intervention of Structure and Role

Table 2. Aspects and Description Related to The Shallot Agribusiness Supply Chain

No.	Aspect	Description
1	Client	Shallot farmers, independent farmer groups, traders/collectors, wholesalers, Ministry of Agriculture, Department of Agriculture, final consumer of shallot consumption and shallot seeds
2	Client's Aspiration	Producing sustainable shallot as much as it can with good quality and structured marketing
3	troubleshooting	It must be conducted in efforts to manage the operation of shallot optimally through guidance to the farmers by implementing the technology according to the SOP, setting cropping patterns, increasing participative collaboration among *stakeholders* in an effort to forge partnerships with industry, improving market access, and maintaining the continuity of shallot supply.
4	Available resources	Partners in the supply chain (agriculture ministry), the trend of the market demand for both shallot consumption and shallot seeds
5	Constraints	The absence of continuity in shallot supply

6	The cause of constraint	There is no adequate support from the institution concerned, shallot farming has not been intended as a profitable business, and farming techniques are still modest
7	Implications of selected issues	If the support from the relevant institutions and the implementation of technology are applied better, then the continuity of production with better quality can be created. It would increase the interest of shallot farmers and make the markets go stronger, especially in achieving structured markets.
8	Reasons to determine the problems	The absence of partnership makes the farmers lack access to the market and fail to manage the sustainable production. The processing of shallot is also unmanaged so that farmers gain unoptimized benefit from their farming
9	Positive value of the issues	The optimal management of shallot supply chain can guarantee the continuity of shallot production with better quality and more secure market access through a partnership so that prices can be stable and build strong institutional farmers.

Relations Between Roles, Values, and Norms

Shallot is a commodity with high economic value and has the potential to generate income for farmers. However, shallot still faces a problem, especially in a series of supply chain problems which have not been resolved until now, namely the unsustainability of production and resulting in price fluctuations. As it is described in the research by Noor, T, I et al, 2015 that shallot prices in West Java since 2013 experienced a tendency to fluctuate due to its production from 2009 which also fluctuated. This condition happened in almost every region in West Java, including Majalengka.

Looking at the phenomenon and the above-mentioned problems, the sustainability of production is still not running well and the farmers still do not have a good bargaining position because there is no certainty of the sale price of shallot. In this case, there is no harmonization of roles that should be done by the actors involved in the shallot agribusiness supply chain, either by primary or supporting actors. There is a lack of role of farmers' groups from production to sales since everything is done individually. Inconsistencies among-roles in the shallot supply chain should be coupled with values and norms agreements in achieving sustainable production of shallot.

Root Definition

Shallot agribusiness supply chain should be maintained and developed to the optimum scale in production sustainability as an effort to meet the market demand both locally and outside the region which is predicted to continue growing with a good entanglement and equitable partnership through the structured market. The attitudes of the actors involved both primary actors and supporting actors, their skills, cultures, and stakeholders which considered as a trigger in production discontinuity would be controlled by various activities in the supply chain.

Relevant Modeling System

"5E" Formulation

In the context of "5E" formulation, various of evaluation activities can be seen starting from the planning activity in the shallot agribusiness supply chain which is expected to reach the development in accordance with the desired transformation by the various parties involved.

Table 3. "5E" Formulation desired by various parties involved in the shallot agribusiness supply chain.

No	Aspect of	Formulation
1	*Efficacy*	The setting of shallot cropping patterns, collaboration and coordination of all actors involved in both primary and supporting in the supply chain of shallot agribusiness to sustain the farming.
2	*Efficiency*	Activities on shallot cultivation pursued in accordance with the SOP
3	*Effectiveness*	Management in the supply chain of shallot agribusiness should be planned optimally in an effort to reach the sustainable production from upstream to downstream
4	*Ethicality*	The development in the supply chain of shallot agribusiness through strengthening the role of farmer groups without reducing the rights of farmers to determine their shallot farm.
5	*Elegance*	Activities on the entire supply chain of shallot agribusiness are done with the consideration of the principle of sustainable production

***Human Activity System* (HAS)**

The context in *Human Activity System* shown a series of activities among the primary actors and supporters of the shallot agribusiness supply chain with their interconnections needed in efforts to achieve the transformation process in accordance with the wishes of all actors involved.

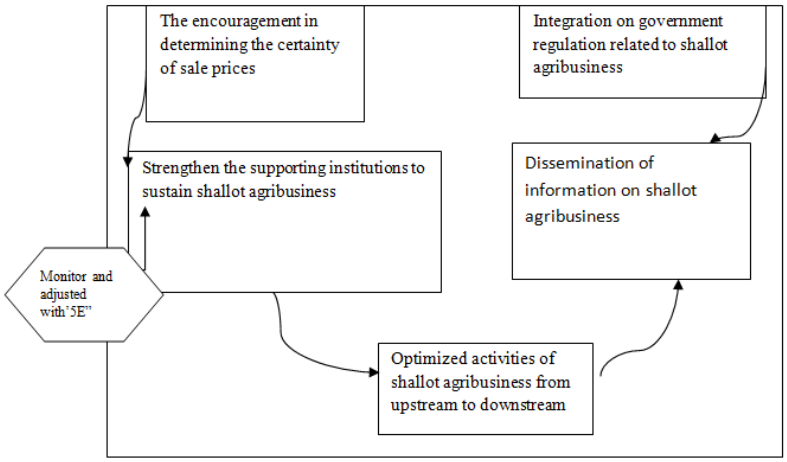

Figure 3. *Human Activity System* (HAS) of shallot agribusiness supply chain

Comparison with Real World Models

The actors involved in the supply chain of shallot agribusiness, either as primary actors or supporters do a comparison of conceptual models, that is a human activity with the real-world system. This condition can be described in the following table :

Table 4. Comparison of Model with the Real World

Activities of the Model	Exist /No	How	Who?	Good /Bad?	Alternative
The encouragement in forming the certainty of shallot sale price	No	Farmers shallot through farmer groups are being involved in determining the sale price, but all this time the farmers were never involved in the determination of prices by traders/collectors or wholesalers	Shallot farmers, farmers groups, traders/collectors or wholesalers	Good	The involvement of shallot farmers in determining the sale price since the agreement of purchase and sale, particularly after the farmers were given the capital loan by the wholesalers.
Shallot agribusiness optimization activities from upstream to downstream	No	farmers through farmer groups must be able to ensure the production process according to the standard operating procedures (SOP)	Shallot farmers, farmer groups, traders/collectors or wholesalers	Good	It should form a partnership with the industry or the existing of structured market
The strengthening of supporting institutions of shallot agribusiness	No	To reactivate the role of cooperatives that have been formed before	Shallot farmer, farmer groups, government (local)	Good	

The integration of government policies in the shallot agribusiness supply chain at all levels of the actors involved	No	Government policies and regulations should support the development of the shallot supply chain as a whole system	Shallot farmers, farmer groups, traders/collectors, government (local)	Good	
The dissemination of information and technology related to the shallot agribusiness	Exist	There should be a motivation to hold a meeting between farmers and farmer groups in applying the technology according to the SOP in shallot agribusiness	Shallot farmers, farmer groups, the government, in this case, the relevant office	Good	Guidance for shallot farmers from related agencies/offices for the implementation of production technology, maintenance, harvesting, post-harvesting

Formulation of Changes

The phenomenon that exists in the shallot agribusiness supply chain and also based on the *rich picture* creates some formulations of the desired changes which were considered culturally relevant, has a meaning and assumed to meet the needs of stakeholders (Checkland, 1990). These changing circumstances can be implemented by the actors involved in the shallot agribusiness supply chain. The following table may explain some of the changes formulation.

Table 5. Changes Formulation of SSM Process in Shallot Supply Chain Sustainability

Activity	**Is it necessary ?**	**Is it can be done ?**	**Possibility of Real Action**
The encouragement in forming the certainty of the shallot sale price	Yes	Yes	Coordination between parties involved in the shallot supply chain should be further optimized in maintaining the fairness of all parties

Shallot seeding which is optimized by certification process and resulted in a good quality of seed managed by farmers groups through cooperation of related parties	Yes	Yes	Coordination and collaboration between shallot farmers' groups and Central Inspection & Seed Certification (BPSB) and related parties
Strengthening the supporting institutions in supply chain of shallot agribusiness	Yes	Yes	To reactivate the cooperatives that have been formed before which is now vacuum in the effort to support activity of shallot agribusiness supply chain
Optimization of shallot agribusiness activities from upstream to downstream	Yes	Yes	▪ Involving the shallot farmers, farmer groups, cooperatives (immediately reactivated), universities, input companies, related agencies which are more active in their respective roles optimally with more intensive coaching and mentoring ▪ Through collaboration and coordination among the relevant parties which motivate farmers in the implementation of technology with the SOP and technology for the sustainable production of shallot
The integration of government regulation related to the shallot agribusiness supply chain	Yes	Yes	▪ Consultations and hearings of shallot farmers, farmer groups, and parties involved in related activities from upstream to downstream viewing from the business needs and policies and government play a proactive role for this ▪ The coaching and motivating to establish the partnerships with structured market

Dissemination of information and technology related to shallot agribusiness	Yes	Yes	▪ Optimization of meetings between the parties through coaching, mentoring, counseling, and guidance/seminars related to more optimal shallot business management. ▪ Optimization of the coaching and mentoring in technological innovation according to the SOP ▪ Coaching and mentoring related to stock management in warehousing to maintain the continuity of shallot supply and its processing

Decision of Actions and Implications of The Research

By looking at the results of the analysis and assessment of the actors, either primary or supporting actors, and those who involved in the operation of shallot agribusiness, and also after through description of: (1) rich picture, (2) cultural analysis of stakeholders and decision makers, (3) the relevant system definition / CATWOE, (4) system modeling relevant to the concept of human activity system (HAS), (5) a comparison of the conceptual model to the real world, (6) the formulation of improvement, then the final stages of activity or business actions are submitted to stakeholders of shallot agribusiness. Various measures for activity improvement process in the shallot supply chain are proposed in efforts for production sustainability so that it would continue to meet the predicted to increase market demand for better quality through the establishment of partnerships with the structured market. As it is shown in Figure 4, there is more optimal development of shallot agribusiness in an effort to continuity of supply as well as a better breeding.

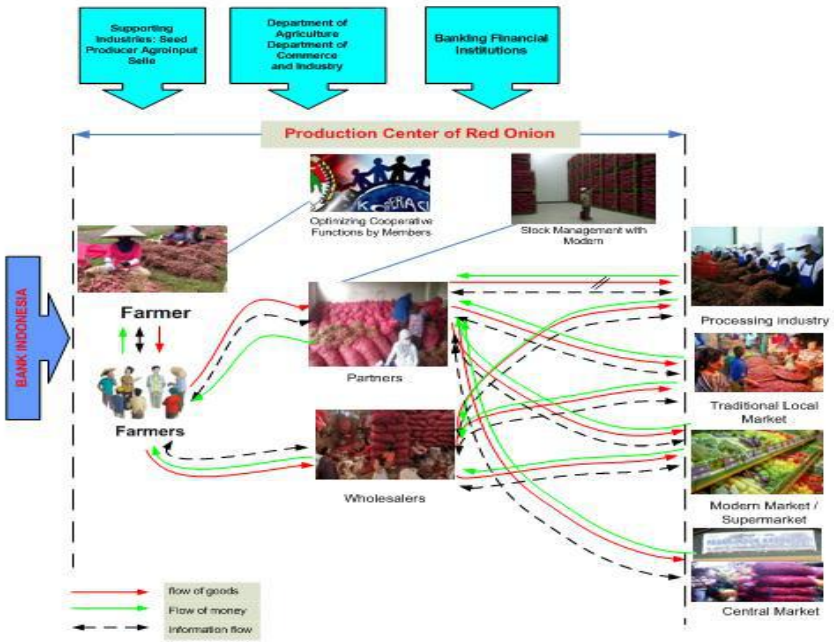

Figure 4. Shallot agribusiness supply chain development

Figure 4 illustrates that the optimal operation of shallot agribusiness with better governance through the reactivation of cooperatives roles that have long been inactive. Cooperatives can facilitate the needs of shallot farmers in the procurement of agricultural inputs, including seeds, which is still a shortage in supply. Cooperatives are also expected to be a bridge access to the structured market thereby facilitating the establishment of partnerships with industrial companies.

Collaborative strategy is one of the strategies in the development of a business, including shallot agribusiness. Simatupang *et al*2012 explained that the collaboration will align supply chain process of creating success value to customer and stakeholder than individual conducting business activities. Related parties such as the department of agriculture, department of commerce and industry, universities, farmer groups, cooperatives, banks, and other parties should be able to collaborate to realize the more optimal shallot agribusiness by performing their respective roles.

In realizing the continuity of production, shallot farmers also need to have a management stock, that is an optimal post-harvest processing of drying and warehousing for balancing the supply in fulfilling the market demand.

Shallot processing should also be further enhanced by the process of mentoring or coaching from related agencies and universities so as to realize the added value for the shallot farmers. Standardization of shallot quality is also necessary to facilitate the marketing process.

CONCLUSIONS

1. A the supply chain of shallot agribusiness in the highland of Majalengka still indicates the constraints in coordination and collaboration among actors for both primary and supporting actors who have not shown a better way/situation.
2. Formulation of changes as a recommendation of this study is the optimization of the agribusiness activities from upstream to downstream through institutional strengthening with the reactivation of cooperatives which have a long-established, the dissemination of information and technology related to the implementation of technological innovation in supporting the continuity of shallot supply with the certainty of the sale price for the farmers.
3. The development of the shallot agribusiness supply chain which would be pursued integratedly by various parties associated with the pro-government regulation.

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Theme : Law, Politics, Education and Social Science

Sub Theme :

1. Regulation and Policy
2. Food Safety Regulation
3. Standardization of Local Food SME Product
4. Local Commodity Product
5. Learning Community and Empowerment
6. Standardization Culinary Local
7. Capacity Building
8. Institutional Strengthening
9. Social Culture Engineering

IDENTIFICATION OF E-COMMERCE OPPORTUNITIES FOR SMALL AND MEDIUM ENTERPRISES OF BANTEN TYPICAL FOOD

[1*)] Aan Hendrayana, [1)] Anwar Mutaqin, [1)] Heni Pujiastuti, [1)] CAHF Santosa, [1)] Syamsuri

[1)] University of Sultan Ageng Tirtayasa, Banten, Indonesia

[*)] Correspondence e-mail: aanhendrayana@untirta.ac.id

Abstract

This research is a preliminary research to develop an information system for commerce of small and medium enterprises (SME) of Banten typical food. One form of product introduction that is currently easy to access by the public is using online media. The research method used in this research is survey method. A total of 89 respondents consisting of sellers of typical food products in Banten province were interviewed. The sampling method used is clustered random sampling by city with the target of the determined respondent, that is the typical food seller. The survey results reveal that there are about 52 typical food produced by the community. Important conclusions from the results are the community has the potential to market their products online, so that its necessity to develop mobile information system that can be applied to smart phones community.

Keywords: mobile information system, typical food, small medium enterprises, e-commerce

INTRODUCTION

Republic of Indonesia Law Number 18 Year 2012 on food explained that the main components of food security are: (i) food availability based on optimal utilization of local resources, (ii) the accessibility of food from the physical and economic aspects by the whole community, and (iii) use of food or food and nutrition consumption to live healthy, active, and productive. One of the efforts to increase the availability of food is by diversifying food based on local resources such as by strengthening micro, small and medium enterprises in the field of food, and development of food industry based on local food (Government Regulation Number 17 Year 2015 on Food Security and Nutrition).

As for the affordability and utilization of food can be improved through the development of food information systems. Food information systems in a region are useful in: (1) assisting the provision of information related to specific food needs in the area (community food assistance program information), (2) provision of information related to food reserves in certain areas (food assistance client referral information, such as pantry food inventory information), (3) data history recapitulation, (4) food donation information, (5) alternative food information in certain areas (information about alternate sources of food), and (6) a range of food assistance client education information (Gareau, 2004). According to FAO meeting, it is stated that "the potential of mobile technology to deliver valuable information to farmers and improve their livelihoods is widely recognized".

In addition, information systems can be used to promote local food products to be widely known to consumers, both in the region and outside its territory. Information on the types of food found in an area reflects the types of food production and the type of food people consume in the area. Thus, the availability of these types of food should be considered. In addition, the development of information technology on the types of food found in the area can foster the activities of e-commerce transactions that can generate community's economy.

According to the Ministry of Village and Development of Disadvantaged Regions of the Republic of Indonesia that the province of Banten still has lagging regions, especially the southern region of Banten. The problems that usually occur in areas that have a weak economic level that is not

optimal development of local resource potential in the development of the economy (Zaini, 2011). In fact, if a region wants to achieve a better economic change, each region should at least know the potential of its resources and be able to optimize these resources. According to Koesnaryo (2008), other causes are weak utilization and accommodation of Science and Technology in community empowerment, the other one is information and communication technology.

Utilization of information technology is able to empower the community. The culture and ability of a society have economic value when there is rapid and accurate information about what they do. With that information, the need for subsequent economic transactions will empower people from start producers, distributors, traders, and supporting devices. For that, there needs to be an information system that can promote the work of the people of Banten which can then be accessed by the wider community, especially the capital and surrounding communities, so the next process of economic empowerment Banten community. This encourages the development of micro, small and medium enterprises in the field of food, and food industry based on local food.

The results of cultural work in Banten include food products. Banten community has the potential of food that has been enthused by the people of the capital and other communities. Food products that can be seeded community Banten Province, for example: *sate-bandeng* (sate of milkfish) from Serang, *kue-balok* (beam cake) from Menes Pandeglang, durian soup from Serang City, *emping* from Labuan Pendeglang, *gula-aren* (palm sugar) from Lebak, and others. However, these food products are not widely known because of the lack of information that can be accessed by consumers. With the information system, consumers can know the food products and specifications, such as; nutritional content, community preference, and location where the product is located. With a good information system, consumers can access quickly, both consumers in the region of Banten, and outside of Banten. When this happens then Banten community economy is empowered. The information system is of course based on Information Communication Technology (ICT) because with it information will be more easily managed and accessed, both by producers and consumers.

The development of ICT-based information systems has a rationale. In the next two years, in Indonesia there will be 128 million people connected to the internet. Of these, Internet users in the capital more than any other region. To that end, Banten people can take bigger opportunities because of the proximity of its territory. Research on online sales (e-commerce) has been done by many researchers. E-commerce has an impact on three major stakeholders, i.e. society, organizations and customers. There are a number of advantages, which include cost savings, expanded efficiency, customization and global marketplaces (Shahriari, Shahriari & Gheiji, 2015). Although e-commerce has many advantages, but the implementation of e-commerce, especially in developing countries are still experiencing difficulties. Developing countries face many obstacles that affect the implementation of e-commerce with the help of comparing with developed country (Khan, 2016).

Implementation of e-commerce in Tanzania shows that Tanzanian SMEs enact three major ecommerce structural practices: (1) Marketing and image-building through use of websites; (2) Technical problem-solving through establishing partnerships (Kabanda & Brown, 2017). In addition, some factors were surveyed in Pretoria East to determine the current adoption status and assessment of SMEs understand the concept and perceived benefits of e-commerce, are: relative advantage, competitive pressure, IT knowledge, security and government support (Garg & Choeu, 2015).

Based on the above considerations, this article aims to explore the initial information in developing the information system. The system is expected to address the obstacles or constraints that are often encountered in the application of information systems in developing countries. Thus, the system can promote food typical of Banten so as to help improve food security, especially in the region of Banten.

RESEARCH METHOD

This study was conducted through a survey of 89 small and medium local foodstuffs typical in Banten. Respondents were interviewed based on a questionnaire prepared with consideration of their knowledge of e-commerce, the availability of technological tools used in e-commerce, and their interest in e-commerce. Knowledge of e-commerce consists of their knowledge of internet and online shopping. The availability of e-commerce support tools consists of the availability of computers, smartphones, and accounts. Then, their interest in using e-commerce consists of the desire to be trained and the desire to use e-commerce.

RESULTS AND DISCUSSION

From the results of interviews with the intended respondents, obtained the demographic picture of respondents as follows :

Table 1. Demographics of Respondents

No	Demographics	Frequency (Percentage)
1.	Gender	
	Male	51 (57 %)
	Female	38 (43 %)
2.	Age	
	Unknow	3 (3 %)
	15-25 years old	9 (10 %)
	26-40 years old	25 (29 %)
	More than 40 years old	52 (58 %)
3.	Duration of business	
	Unknow	2 (2 %)
	Less than 5 years	28 (31 %)
	5-10 years	30 (34 %)
	More than 10 years	29 (33 %)
4.	Business turnover per month (IDR)	
	Unknow	
	Less than 10 million	12 (12%)
	10 – 100 million	34 (38 %)
	More than 100 million	35 (40 %)
		8 (10 %)

Based on Table 1, it is illustrated that there is a tendency that food business actors in this area are over 25 years old who have undergone the business for at least more than 5 years and have turnover ranging from 10-100 million per month.

Banten Food Distribution Information

In the activity of this survey, we obtained a list of typical food Banten. Table 2 below is the name of typical Banten food still produced and marketed. Based on the table, snacks are the most widely produced type of Banten food. However, for the number of business actors, *Sate Bandeng* (10%) and *Pecak Bandeng* (10%) is the most widely marketed food by SME's actors.

Table 2. List of Banten Foods that are still produced and marketed

	Name of Banten Typical Food				
1	*Nasi Gonjleng* (Gonjleng rice)	*Pecak Bandeng* (milkfish pecak)	*Kue Balok* (balok cake)	*Kue Apem* (apem cake)	*Gula Merah* (palm-sugar)
2	*Nasi Uduk* (uduk rice)	*Pecak Gabus*	*Ketan Bintul*	*Opak*	*Angeun Lada*
3	*Nasi Bakar* (roasted rice)	*Sate Bandeng* (milkfish roasted)	*Jojorong*	*Kue Aug-aug*	*Emping*
4	*Soto Santan* (santan soup)	*Sate Bebek* (sate of duck)	*Talam*	*Blondo Kelapa*	*Dendeng*
5	*Nasi Jagal* (jagal rice)	*Laksa*	*Gegetas Beras*	*Keceprek*	*Balado Kulit Melinjo*
6	*Nasi Sumsum* (sumsum rice)	*Gerem Asem*	*Gemblong/Buras*	*Kue Dongkal* (dongkal cake)	*Abon Bandeng*
7	*Bakso Ikan* (meatballs of fish)	*Rabeg*	*Kue Semprong* (semprong cake)	*Kerupuk Pindang*	*Abon Gadeng*
8	*Bakso Ikan Malimping* (malimping meatballs of fish)	Botok Ayam (chicken botok)	*Otak-otak*	*Gecom*	*Bolu Tape*
9	*Bubur Bontot* (bontot porridge)	*Sop Ikan* (fish soup)	*Asinan*	*Dodol*	*Towol*
10	*Karedok*	*Bandeng Jagal*	*Ranginang*	*Getuk Singkong*	
11	*Kue Engkak* (engkak cake)	*Lapis Beneng*	*Gegetas Beras*		

Table 3. Distribution of SME's Location of Banten Typical Food

No	Location	Frequency (Percentage)	The Most Food Which Marketed
1.	Serang City	34 (38 %)	*Pecak Bandeng* (pecak milkfish), *Sate bandeng* (milkfish roasted), *Rabeg*
2.	Serang Regency	10 (11 %)	*Sate Bandeng* (milkfish roasted)
3.	Cilegon City	16 (17 %)	*Sate Bebek*
4.	Pandeglang Regency	9 (10 %)	*Kue Balok*
5.	Lebak Regency	5 (5 %)	*Keceprek*
6.	Tangerang City	7 (8 %)	*Pecak Bandeng*
7.	Tangerang Regency	7 (8 %)	*Laksa*
8.	South of Tangerang City	3 (3 %)	*Pecak Gabus, Nasi Jagal*

Information About SME's Marketing

Characteristics of marketing undertaken by this SME's actor, as follows :

Table 4. How SME's Actors Promote Their Products

No	Way of Marketing	Number of SME (Percentage)
1.	Word of mouth	78 (79 %)
2.	Ads on the radio	1 (1 %)
3.	Cooperation of travel agency	2 (3 %)
4.	Internet	4 (9 %)
5.	Banner	1 (1 %)
6.	Work with multiple stores	2 (2 %)
7.	Others	1 (4 %)

Based on Table 4, obtained a description of the promotion made by SME's Banten typical food business is that only about 5% utilize internet technology. Thus, the marketing potential in social media has not been seriously worked out. Therefore, it is necessary for the interest of SME's actors and also the assistance so that the potential of such marketing can be achieved.

Information About SME's Interest to e-Commerce

Table 5. Interest of SMEs to e-commerce

No	Description	Want to Joint Online Business		Want to be Trained	
		Yes	No	Yes	No
1.	Gender				
	Male	12 (21 %)	8 (14 %)	11 (26 %)	4 (9 %)
	Female	29 (51 %)	8 (14 %)	19 (44 %)	9 (21 %)
	Missing : 1				
2.	Age				
	15-25 years old	3 (5 %)	- (%)	2 (5 %)	- (0 %)
	26-40 years old	12 (21 %)	4 (7 %)	12 (29 %)	3 (7 %)
	More than 40 years old	25 (45 %)	12 (21 %)	14 (34 %)	10(24 %)
	Missing: 4				
3.	Duration of business				
	Less than 5 years	11 (20 %)	4 (7 %)	9 (21 %)	2 (5 %)
	5-10 years	16 (29 %)	6 (11 %)	13 (31 %)	5 (12 %)
	More than 10 years	13 (23 %)	6 (11 %)	8 (19 %)	5 (12 %)
	Missing: 3				
4.	Business turnover per month (IDR)				
	Less than 10 million	21 (43 %)	5 (10 %)	14 (31 %)	4 (12 %)
	10 – 100 million	15 (35 %)	6 (12 %)	11 (32 %)	3 (9 %)
	More than 100 million	1 (2 %)	2 (4 %)	1 (3 %)	1 (3 %)
	Missing: 13				

Based on Table 5, it is found that Banten business people have an interest to do e-commerce, especially small-turnover SME. Of the 80% who have the willingness to be able to sell online, it is traced that 71.43% willing to be trained to use e-commerce. As for the respondent's experience on e-commerce it is stated that 13.80% feel e-commerce is difficult and the rest states e-commerce is easy

to apply. The following tables 6 and 7 provide information on the reasons presented by SME's typical of Banten specialties related to online promotion.

Table 6. Reason Why SME's Actor Want to Use e-commerce

No	Reason	Frequency (Percentage)
1.	It is increasingly recognized by the wider community	21 (24 %)
2.	In order for people who know themselves	1 (1 %)
3.	Increase sales and visitors	13 (15 %)
4.	Marketing will be faster and easier	3 (4 %)
5.	Facilitate promotion	27 (30 %)

Table 7. The Reasons Why the SME's Actor Do Not Want to Use e-commerce

No	Reason	Frequency (Percentage)
1.	Already believe in selling itself	1 (1 %)
2.	So that buyer comes directly	1 (1 %)
3.	Items sold are not durable	4 (5 %)
4.	Enough with conventional promotions	1 (1 %)
5.	Too many orders	1 (1 %)

Based on Table 6 information, online sales promotion activities have the potential to be developed. Promotion is expected to provide good knowledge to the community related to typical food Banten, both forms and how to get it. Therefore, the developed information system is expected to meet these expectations.

Similarly, the reluctance of SMEs in Banten to do online sales generally assumes that online sales will not affect the turnover achieved. Therefore, the need for efforts to disseminate information systems potential food of Banten food so as to be able to convince that with the information system will provide great benefits in the advancement of marketing of this typical Banten food.

The information system to promote Banten food products is in line with the opinion of Gareau (2004) that the information system serves as the provision of food information in the region. In addition, the development of information technology on the types of food found in the area can foster the activities of e-commerce transactions that can generate community's economy. This is in line with the opinion on the Workshop on Mobile technologies for food security, agriculture and rural development. Role of the public sector that "Information technology supports this interconnectivity by providing the foundation for implementing business processes". Thus, food-related information technology greatly contributes to the role of government in the development of national food security.

CONCLUSION

Based on previous exposure, it was found that there are about 52 typical food produced by the community. Most of the promotional tools are still very conventional, which is 79% by "word of mouth", 9% using internet, and 3 % by cooperation with travel agency or using posters installed in their stores. As many as 80% said they want all products promoted online. Important conclusions from the results of such research include, i.e.: (1) the community needs other promotional media to market its products, (2) the community has the potential to market their products online, (3) the need to develop mobile information system that can be applied to smart phones community, (4) conducted training on the use of mobile applications, online transaction ethics, and troubleshooting related applications and transactions online.

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INSTITUTIONAL PATTERN OF PASUNDAN CATTLE IN GIRIKARYA FARMER GROUP (CASE STUDY IN DUKUHBADAG VILLAGE, KUNINGAN DISTRICT, WEST JAVA)

[1*)] Marina Sulistyati, [1)] Linda Herlina, [1)] Maman Paturochman, [1)] Anita Fitriani, [1)] Achmad Firman, [1)] Munandar Sulaeman , [1)] Firdha Azalia

[1)] Faculty Animal Husbandry of Padjadjaran University

[*)] Correspondence e-mail : marina.sulistyati@unpad.ac.id

Abstract

Pasundan Cattle in Kuningan have highly potential to be developed, due to the characteristics of a Pasundan cattle like which are quickly adjust to the physical and social environment, and have superiority quantitative i.e. have the largest proportional of carcass. The purposes of this research were knowing the characteristics member, analysing dynamical group and analysing the institutional patterns of Pasundan cattle in Giri Karya farmers group. This research conducted a case study with a qualitative approach. Informants are chosen by purposive sampling, analysing model used a descriptive analysis based on information from informant in the field, The results showed that characteristics of the farmers in Giri Karya group based on age, formal education and experience in breeding, dynamical group in Giri Karya have strengths and weaknesses in each of its elements, and the pattern of institutional in Giri Karya have been quite well.

Keywords: farmers characteristic. dynamical group, institution pattern

INTRODUCTION

Pasundan cattle is one of the genetic resources of livestock local that has very important economic, social, and environment, in addition to national assets is necessary not only for today but also for future purposes. The presence of Pasundan cattle has a capable of creating jobs for the surrounding community so as to bring in revenue. One of the aspects which can help the development of this commodity is the existence of institutional Pasundan cattle farms.

Institutional is a part of Pasundan cattle development to bridge producers and the market. The establishment of institutional itself is a place to learn, work, and solve problems that may be happen. It is important to support their business development. On site research, it can be found that Giri Karya group is a group of farmers who keep Pasundan cattle where this group has got some Pasundan cattle from local government as a grant.

A group of farmers Pasundan potentially to be the appropriate container in the local cattle development program of West Java, if managed properly. Farmer groups play an important role in supporting the development process of a Pasundan cattle because the group will be expected to develop a pattern for better maintenance. Conditions in the field suggests that the role of the group is not optimal, so that the institutional pattern is not optimal either.

The purposes of this research are to understand the characteristics of group member breeders; analyze dynamics of the Giri Karya group; and analyze the Pasundan cattle institutional pattern in the Giri Karya group

RESEARCH METHOD

The method in this research is a case study with a qualitative approach. Informants were needed to explore information related with research and they were chosen by accidental sampling. A sampling technique deliberately or pointing between members of a population to be sampled (Tan &

Willie, 2002). In this study, the informants involved consist of farmers who being a member group and government staffs who work in related service. Number of informants selected were 10 informants. Indepth interviews is a model approach to collect information due to qualitative research is holistic, dynamic, and out general.

RESULTS AND DISCUSSION

There are three kinds of results research that explain bellow, that are: characteristics of the farmers, group dynamics, and institutional Pasundan cattle.

Farmers Characteristic

The farmer characteristics on site field can be described in some variables such as age, level of formal education, experience raising, possession scale and cosmopolitan. The description of the variable characteristics farmer are described in Table 1.

Tabel 1. The Characteristic of Farmers Pasundan Cattle in Giri Karya Group

No	Characteristic	Total Number	
		People	%
1	Age		
	< 15 years	0	0
	15 – 65 years	7	70
	> 65 years	3	30
2	Formal Education		
	Elementary	0	0
	Junior high school	5	50
	High school	1	10
	Academy	4	40
3	Farmers experience		
	< 0 years	0	0
	10 – 20 years	1	10
	> 20 years	6	60
4	Owner livestock		
	1 – 3 heads	8	80
	4 – 6 heads	2	20
	≥ 7 heads	0	0

Notes: Informant total = 10 farmers

Table 1, shows that 70% of farmers are productive age, so the informant is powerful enough to maintain the farm, while formal education determined that the education level of our informants vary greatly from elementary school to university. It means that keeping Pasundan cattle is being familiar in the range of education level. Next, informants have a good experience to keep cattle which showed by 70% of respondents ≥ 20 years experience due to the farm continued from his parents, so it is quite experienced in the management of cattle. This business is conducted from generation to generation, and their parents transfer knowledge to manage cattle. Small scale dominated informants, 80% of respondents possess 1 – 3 cattles. This situation is happen due to lack of capital, modal, and artificial insemination service from government.

Dinamic Giri Karya Group

The dynamics can be described as a pattern of interaction among members of a group which reciprocal interaction (Santosa, 2009). Meanwhile a group is a place to people interacting with each other on a regular basis over a certain period, and they contended that arises a sense of interdependence with each other (Winardi, 2007). Group dynamics can be analyzed through the elements in it, that is the purpose of the group, group structure, function of the task groups, development groups, group cohesiveness, the atmosphere, pressure group, and effectiveness of the group. All the elements of dynamics are based on powers of members in the group as confident that being part of group, not forced and the type of activities is clear. Then believe that the leader of the group is selected based on the mutual agreement to keep all members of the group. Based on this strength, arise foundation for developing livestock Pasundan.

According to group, group dynamics Giri Karya has been built through the cooperation among members of the coupled with coaching or motivation of group members that are directed at the development of the livestock especially cattle Pasundan grants. While coaching a group internally concerns the capacity of members in the performance of its duties and functions.

Table 2. Dynamic Giri Karya Group

No	Dimension	Description
1	Purpose of the group	Not reach yet
2	Group structure	Already did the recording of data group
3	Function of the task group	Already implemented
4	Development of the group	Not reach yet
5	Group cohesiveness	Happen to good cooperation
6	The atmosphere of the group	Keep the culture and attitude of the members
7	Group pressure	The nature of the firm and disciplined in the group
8	Group effectiveness	Not reach yet

According to the Table 2 above, the purpose of the group as the first dimension suggests that support informant against the purpose of the Group and the level of understanding of members is high enough to make it happen, this is evident from their desire to have the supporting facilities maintenance Pasundan cattle, in addition they also hope there is progress in the group in terms of improved management maintenance. The structure of a group already formed and implemented although not optimal, there were already divisions but has not been fully performed well over-all, but the Group has already done the work of recording Giri Karya data groups.

The function of the task groups include: a) as a class learning; b) building cooperation; c) production units. Farm business is seen as one of the business which can be developed to achieve the goals. The development group is examined based on three dimensions: the facility group, control group activities, and the process of socialization. The third dimension showed that the facilities there are in the form of group activity to develop quality human resources is not a physical facility. The control group activities have not done yet to execute all members of the role. Groups have conducted cooperation between the Chairman with members or fellow members with regard for grants Pasundan

cattle, then only involves only certain members of the group, so it appears a different understanding. The atmosphere is cozy enough Group of Giri Karya as all members have a culture of good manners fellow group members nor the environment outside of the group. Members of the Giri Karya do not feel depressed in groups, but the attitude of the firm and disciplined the Chairman to members make all individuals obey and dare not make mistakes of implementation activities groups. Cohesiveness group has not been achieved because the purpose of the group that became the main important thing is manifested actually unbalanced with the spirit and efforts of members. Some of the limitations of the the restrictions arising between members.

The Institutional Patterns of Cattle Pasundan Group Giri Karya

Institutional that based on the basic concept according to the (Horton, 1964) is a system of organize and social relationships being formed from common values and ways of bringing together several basic human needs. Table 3 shows the pattern of institutional cattle in the Dukuhbadag village, Cibingbin sub district, Kuningan Regency.

Tabel 3. The Institutional Pasundan Cattle

No	Dimension	Description
1	Culture	Supporting life
2	Social structure	The improvement of the status and role of the farmer
3	Social Relation	The increase in social relationships

Table 3 shows that the pattern of institutional farmers can be seen on the basis of three diemsion: a) culture/values of the farm; b) social structure; c) social relation pattern. The value of the farm showed that informants regard cattle as wealth and savings as well as featured as the mainstay to meet life, although the ownership of livestock most informants only ranges 1-3 heads, but this effort is already a major job, supporting life and also a considerable income for farmers. Ownership of cattle farm can reflect the social structure of society, that the more advantage will get an status will increase the role of farmers ranchers. The status of a farmer mostly as ordinary citizens who do not hold a certain position or role, but by joining the group their role shall be increased because there are informants as a Member who gets access to livestock business guidance and information about the management of farms.

The pattern relationship farmers indicates an increasing in social relationship especially with relevant agencies such as the Department of livestock, other universities or with a cattlemen. Improved social relations make knowledge increased, so that farmers are more confident to manage his business.

CONCLUSION

Based on the results of research that has been done, the conclusion that :

a. Characteristics members of Pasundan cattle farmers can support activities Group and the development of productivity Pasundan Cattle. The largest proportion (70%) has been influanced by productive age, a level of formal education. Informants consist of vast level from elementary school to university, 70% of respondents in particiular have ≥ 20 years experience due to the farm continued from his parents.
b. Dynamical Girikarya group have strengths and weaknesses in each dimension and this group including as a sufficient dynamic group.

c. The pattern institutional of Pasundan Cattle in Girikarya group has not been stable and has a a weak cultural in their social mechanism.

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THE CORRELATION OF NUTRITIONAL SATUS AND HAEMOGLOBIN LEVEL ON WOMAN OF REPRODUCTIVE AGE IN YOGYAKARTA

[1*)] Tri Marwati, Mahargono, [1)] Purwaningsih, [1)] Titiek F. Djaafar, [1)] Siti Dewi Indrasari, [2)] Toto Sudargo

[1)] Assessment Institute for Agricultural Technology of Yogyakarta, Indonesia
[2)] Medicine Faculty of Medicine, Gadjah Mada University Yogyakarta, Indonesia

[*)] Correspondence e-mail: watipasca@yahoo.com

Abstract

Nutritional status is very important in the context of food security. One of the factors associated with the level of haemoglobin in the body is the intake factor, including the nutritional status of a person. Therefore this study aims to determine the relationship of nutritional status with hemoglobin levels in women of reproductive age. This research is an observational research with cross sectional study design. The study was conducted in Yogyakarta with the research subjects amounting to 321 woman of reproductive age, by measuring anthropometry in the form of body weight and height as well as interview and analysis of haemoglobin level. Result of statistical test of correlation between nutritional status with hemoglobin level by using chi square analysis yield value p = 0,017, p <0,05. It can be concluded that there was a correlation between nutritional status and haemoglobin level in woman of reproductive age in Yogyakarta.

Keywords : nutritional status, haemoglobin level, woman of reproductive age

INTRODUCTION

Anemia continues to be a major public health problem worldwide, particularly among females of reproductive age in developing country. The prevalence of anemia in women occurs in India (Bentley and Griffiths, 2003; Gupta *et al.,* 2014), Cambodia (National Institute of Statistics, 2014; Makurat *et al.,* 2016) Nepal (Chandyo, *et al.,* 2007), Ethiopia (Gebremedhin and Enquselassie (2011), Bangladesh (Hossain *et al.,* 2013) and Indonesia (Sahana and Sumarmi, 2015). Anemia is a condition which the number and size of red blood cells or the haemoglobin concentration below the normal value, that can damage the capacity of the blood to transport oxygen throughout the body. Anemia is one of the causes of still high maternal mortality (MMR) and infant mortality rate (IMR) in Indonesia which is still at 228 thousand per 100,000 births and 34 babies per 1,000 births. Great efforts are needed to achieve the 2015 target of 102 and 32 per 100,000 live births (BAPPENAS, 2010).

Anemia is caused by diets that lack sufficient amounts of essential hematopoietic nutrients, such as iron, vitamin A (VitA), vitamin B12 (VitB12) or folic acid, to meet the need for hemoglobin (Hb) and red blood cell synthesis (WHO, 2001; Koury and Ponka, 2004). Non-nutrition factors are especially menstrual blood loss, genetically determined hemoglobinopathies and parasite infestation, such as in malaria and helminths (WHO, 2001; Charles *et al.,* 2012). Haemoglobin level in the body can be an indicator of anemia or not. Lack of red blood cells or haemoglobin in the blood can be caused by rapid blood loss or because of too slow the production of red blood cells. This reflects the disruption of haemoglobin synthesis or erythrocyte production. One of the factors associated with the status of haemoglobin in the body is the intake factor. Factor intake also form a person's nutritional status, therefore in this study aims to determine the relationship of nutritional status with haemoglobin level in woman reproductive age, in the Province of Yogyakarta Special Region.

RESEARCH METHOD

This research is an observational research with cross sectional study design (Haloi and Limbu, 2013; Mukarat *et al.,* 2016). The study was conducted in five districts in Yogyakarta Province with 321 women of reproductive age. The study was conducted by anthropometric measurement in the form of body weight and height towards women of reproductive age as well interviews and measurements of haemoglobin level. Determination of nutritional status of woman of reproductive age in this study using indicator BMI (Body Mass Index). BMI is a very simple tool to monitor the nutritional status of adults especially those related to deficiency and overweight, then maintaining a normal weight allows a person to reach a longer life expectancy. BMI is a mathematical formula related to body fat and expressed as weight (in kilograms) divided by high square (in meters) (Bentley and Griffiths, 2003; Suliawati, 2013). The BMI threshold category for Indonesians is <17 indicating severe weight deficiency; 17-18,5 denotes mild weight deficiency; 18.5-22.9 normal category; 23-24.9 indicates mild degree of excess weight; > 25-29.9 indicates moderate overweight (obese I); > 30 signifies severe weight (obes II) (Sirajuddin, 2012 in Suliawati, 2013). Cut off Point haemoglobin for the diagnosis of anemia in women of reproductive age is <12 g / dl (Murray et al., 2006). Statistical analysis of the relationship between nutritional status and haemoglobin level of reproductive age women using chi square test (Rai *et al.,* 2016).

RESULTS AND DISCUSSION

Age of woman in reproductive age

The study population of reproductive age woman was separated into four groups, according to their age, below 20 years, 20-40 years, 41-60 years and above 60 years. The frequency of these age-groups was 4, 281, 35 and 1 respectively (Table 1).

Table 1. Characteristics of subjects by age

Age of subject (years)	Frequency	Procentage
<20	4	1,20
20-40	281	87,50
41-60	35	10,90
>60	1	0,30

Nutritional status of woman in reproductive age

Among the studied population (321 reproductive age women), majority of them (170 that is 53, 20%) belong to more nutritional status, 123 woman (123 that is 38,40 %) belong to normal nutritional status and the rest (28 that is 8,40%) belong to less nutritional status (Table 2)

Table 2. Nutritional status of subject

Nutritional status	Frequency	Procentage
Less	28	8,40
Normal	123	38,40
More	170	53,20

When viewed the distribution of nutritional status by age, in women <20 years age group no one suffered from malnutrition and most of the nutritional status is normal. In the age group of 20-40 years and 41-60 years of women more nutritional status, more than normal nutritional status. In the age group> 60 years there is only one person and nutritional status is classified as more nutrition (Table 3).

Table 3. Nutrition Status by Age

Age of subject (Years)	Number		Nutrition Status					
			Less		Normal		More	
	n	%	n	%	n	%	n	%
<20	4	1,2	0	0	3	0,9	1	0,3
20-40	281	87,5	26	8,1	103	32,1	152	47,4
41-60	35	10,9	1	0,3	14	4,4	20	6,2
>60	1	0,3	0	0	0	0	1	0,3
Total	321	100	27	8,4	120	37,4	174	54,2

According to Griffiths and Bentley (2001) the differences in women's nutritional status were mainly related to women's access to resources and income, including better food and access to health care, regardless of whether they lived in rural or urban areas. A large difference in female BMIs associated with residential locations (urban vs. rural), socioeconomic status, and other variables. It is reported that in rural areas more than 37% of women have low BMI (<18.5 kg / m2) whereas in urban areas 12.1% women have low BMI and 37% of women have high BMI. Hossain *et al.,* (2013) reported that urban pregnant women were well nourished than rural pregnant women comparatively and also obesity was encountered as an indicator in urban pregnant women than rural. Sinha and Haldar (2015) reported that approximately 3 out of 4 women belonging to the reproductive age group with low socio-economic status in Paschim Medinipur district had low haemoglobin levels and positive association were noted between weight, height, WC, WHR of these women.

Mukarat *et al.,* (2016) reported that the poor iron status seems to contribute to the overall prevalence of anemia of female workers. Low haemoglobin and iron deficiency affected both underweight and those not underweight. Despite the fact that body mass index was negatively associated with iron stores, true differences in iron status between underweight and not underweight participants cannot be confirmed. Laillou *et al.,* (2014) study a scross-sectional among 1530 Vietnamese women of reproductive age reported positive associations between BMI with Hb and plasma FER, although this was not associated with a different prevalence of anemia or iron deficiency among different BMI groups

Correlation of Nutritional Status and Haemoglobin Level of woman in reproductive age

This study noted that prevalence of anemia in the study was 176 women (54,8 %) with less haemoglobin status, and the rest, 145 woman (45.2%) had normal haemoglobin status (Table 4). So the result suggest that the prevalence of anemia is much high (54,8%) in this population. This is lower than the studies of different states of India which report a prevalence of anemia as 55,3% while in West Bengal it is reported as 63,2% (IIPS, 2007), and among the rural female of Madhya Pradesh India 82 % (Gupta *et al.,* 2014). But this is higher than that of Bentley and Griffiths (2003) that of 4032 married women aged 15 to 49 from India have a high prevalence of anemia (48.8%), 32.4 %, 14.2 and 2.2 experienced mild, moderate and consecutive severe anemia. Classification of women as less or normal anemic based upon their haemoglobin status and following international references (WHO, 1992). A haemoglobin concentration of less than 7g/dl was used to define severe anemia, 7–9,9 g/dl for moderate anemia, and 10–10,9 g/dl to correspond to mild anemia in pregnant women and 10–11,9 g/dl for non-pregnant women. From Cambodia Demographic Health Demographic Survey reported 45% of women of reproductive age (15-49 years) were anemic (National Institute of Statistics, 2014). Chandyo *et al.* (2007) found the prevalence of anaemia among nonpregnant women in Nepal to be only 12.0% while Gebremedhin and Enquselassie (2011) found 27.4% among the women of reproductive age in Ethiopia. Makurat *et al.* (2016) report that the prevalence of anemia among 223 female workers (non-pregnant) in a garment factory in Phnom Penh, Cambodia to be 22.1%. Hossain *et al.,* (2013) found the prevalence of anemia among 200 pregnant women in Kustia, enaidah, and Jessore, Bangladesh to be 16% (urban woman) and 19% (rural woman). When the researchers

compared their result with the international scenario, it is observed that it is much higher than the global prevalence of anaemia among women which is 30.2% (McLean *et al.* 2007).

Small-scale studies conducted in India regarding micronutrient deficiency confirm the high prevalence of anemia in girls and women (Chakma et al. 2000, Rajaratnam et al. 2000). Malnutrition among women in reproductive age, with respect to underweight, anemia and micronutrient deficiencies, is associated with numerous poor health related outcomes, such as impaired cognition, reduced work capacity and impaired immune responses, leading to lowered resistance to infections [WHO, 2001; WHO, 1995; Black *et al.,* 2013) Haemoglobin is closely related to iron. Iron deficiency will inhibit the formation of haemoglobin which results in inhibition of red blood cell formation. Pregnant women and lactating mothers are at high risk for anemia caused by iron deficiency. Iron is obtained from food, both daily food and supplements or supplements. Therefore intake is strongly related to iron. In addition, intake also affects nutritional status.

Table 4. Correlation of nutritional Status and Haemoglobin levels

Haemoblobin Levels	Nutrition Status (BMI)						Total		p
	Less		Normal		More				
	n	%	n	%	n	%	n	%	
Less	14	4,4	78	24,3	84	26,2	176	54,8	0,017
Normal	13	4	42	13,1	90	28	145	45,2	

The result of statistical test of correlation between nutritional status with haemoglobin level of reproductive age women using chi square analysis obtained p value = 0,017, p <0,05 (Table 4). It may be noted that the haemoglobin level of woman in reproductive age in the study is positively correlated with nutritional status. The results of this study is in accordance with Haloi and Limbu (2013). It is concluded that a general trend in the study population of women with high fertility having poor nutritional status. These findings might be important in formulating responsive health policies in an underdeveloped region. Similar results were also found by Marlapan *et al.,* 2013 (in Rai *et al.,* 2016), that there is a relationship between nutritional status to haemoglobin levels in pregnant women in Manado Indonesia.

In line with the results of this study, it is known that there is a significant relationship between income on pregnant women haemoglobin levels. Where low socioeconomic status is associated with an increased risk of anemia in pregnancy. It is clear that incomes are low, the prevalence of anemia is increased (Lokare *et al.,* 2016). A good intake will lead to a good nutritional status. If the intake is good, according to what is needed by the body then the possibility of iron intake will be fulfilled. If the intake of iron is adequate then the formation of haemoglobin will not be disturbed so that the willingness of blood haemoglobin status is fulfilled.

This study's results on BMI (Table 4) indicate that normal and overweight (as per BMI) also exhibit high percentage of anaemia suggesting a non-existence of correlation of BMI and haemoglobin level. This suggest that not only under nutrition but some oth er factors including pathophysiological, psychological, low healthy diet, unhygienic sanitation, inadequate health care facilities attribute to anaemia. While analyzing the data on BMI the researchers noticed a decreasing trend of BMI value from mild to severe anaemia, although no statistical significance could be established. It may be noted that Ghosh and Bharati (2003) reported a decreasing trend of BMI among Munda and Pod women along with low level of haemoglobin.

The causes of high prevalence of anemia in women due to various factors include inadequate iron intake and low iron absorption. The formation of red blood cells depends on an adequate supply of essential ingredients, some of which are not available in the body but must be provided through food. One of these is iron deficiency anemia, which occurs when there is not enough iron available for the haemoglobin formation process. Often seen in women of reproductive age, caused by blood loss during menstruation and increased iron demand during pregnancy (Price and Wilson, 2005). More than 50% of the largest cases of anemia worldwide are directly caused by lack of intake of iron (Sumarmi in

Sahana 2015) and lack of one or more micronutrients that play a role in iron metabolism, erythropoesis, or haemoglobin formation, Fe), zinc (Zn), vitamin A, and vitamin C (Ekayanti, 2007).

Acording to Muslimatun *et al.,* (2001) weekly supplementation with iron and vitamin A during pregnancy increases haemoglobin level in Indonesian pregnant women. Sahana and Sumarmi (2015) reported that on average haemoglobin levels in women of reproductive age in Probolinggo Jawa Tengah were 12.01 ± 1.24 g/dl with anemia prevalence of 42.25%. Statistical results showed that vitamin A intake correlated with haemoglobin level ($p = 0.015$; $r = 0.287$). This is in line with the theory about the function of vitamin A is to help the absorption of iron and help the process of formation of haemoglobin. Iron with retinol will be transported by Retinol Binding Protein (RBP) and transferrin synthesized in the liver so that the impact of vitamin A deficiency is the occurrence of mobilization disorders in the iron from the liver or the incorporation of iron to erythrocytes.

CONCLUSION

From result of analysis using chi square analysis got value $p = 0,017$, $p < 0,05$ so it can be concluded that there is correlation between nutritional status with haemoglobin level in woman of reproductive age. In addition to nutritional status, haemoglobin levels are influenced by other factors so that research needs to be done with other variables that are likely to affect haemoglobin levels. In this study the determination of nutritional status is made with BMI indicator, for further research can also be combined with other indicator related. New program strategies are needed, particularly those that improve the overall nutrition status of women of reproductive ages.

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THE RELATIONSHIP BETWEEN AGE AND HEMOGLOBIN STATUS AT REPRODUCTIVE AGE WOMEN IN YOGYAKARTA PROVINCE

[1*)] Titiek Farianti Djaafar, [1)] Erni Apriyati, [1)] Muhamad Fajri, [1)] Siti Dewi Indrasari, [2)] Totok Sudargo

[1)] Department of Postharvest Technology, Assessment Institute for Agricultural Technology Yogyakarta, Indonesia
[2)] Departments of Nutrition and Health, Faculty of Medicine, University of Gadjah Mada, Yogyakarta, Indonesia

[*)] Correspondence e-mail : titiekfd@yahoo.co.id

Abstract

Research about relationship between hemoglobin statuses with age at reproductive age women in Yogyakarta has not been done. The objective of this study was to know the association of age with hemoglobin status in reproductive age women in Yogyakarta Province. The research was conducted using observational method with cross sectional design. The study was conducted in four districts and one municipality in Yogyakarta Province, 321 people as responden reproductive age women. The data collected included age, body weight, body height, nutritional status and hemoglobin level. Statistical test of relationship between age and hemoglobin status was conducted using chi square test. The result shown that 54.8% the reproductive age women have less hemoglobin status. The statistic test result shown that p value = 0.682 (p> 0.05), in meaning there is no relation between age and hemoglobin status in reproductive age women in Yogyakarta Province.

Keywords : age, reproductive age women, hemoglobin status

INTRODUCTION

Anemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development. It occurs at all stages of the life cycle, but is more prevalent in pregnant women and young children (WHO, 2008). The prevalent of anemia is estimated 9% in developed countries, whereas in developing countries the prevalent estimated is 43%. Children and reproductive age women are the most risk group, with anemia prevalent estimate in infants about 47%, pregnant women 42% and non-pregnant women (15-49 years) amount 30% (McLean *et al*., 2009). World Health Organization (WHO), targets 50% reduction of anemia prevalent at reproductive age women on 2025 (WHO, 2014).

Globally, the most significant contributor to the onset of anemia is iron deficiency so that iron deficiency anemia (IDA) and anemia are often used synonymously, and the prevalence of anemia has often been used as a proxy for IDA. It is generally assumed that 50% of the cases of anemia are due to iron deficiency (WHO, 2001). The main risk factors for IDA include a low intake of iron, poor absorption of iron from diets high in phytate or phenolic compounds, and period of life when iron requirements are especially high (i.e. growth and pregnancy).

Malnutrition deficiency in pregnant women affects the mortality of mother during childbirth, infant mortality rate and low life expectancy. Rasmaliah (2004) mentioned that anemia is an important cause behind the incidence of morbidity and mortality, namely maternal mortality during pregnancy and at the time of childbirth or childbirth as a result of pregnancy complications. In addition, pregnant women who suffer from anemia also shows a tragic situation, namely the occurrence of excessive bleeding during childbirth. In addition to its effects on death and bleeding, anemia during pregnancy affects fetal growth, low birth weight and increased perinatal death. Anemia is one of the causes of still

high maternal mortality (MMR) and infant mortality rate (IMR) in Indonesia which is still at 228,000 per 100,000 births and 34 babies per 1,000 births (Bappenas, 2010). Anemia is also a haematological disorder that is found in elderly people. Anemia in children can be caused by iron and micronutrient deficiency intake such as vitamins (McLean *et al*., 2009).

The main cause of anemia in Indonesia is low iron intake (Fe). Iron nutritional anemia can lead to decreased physical ability, work productivity, and thinking ability. In addition, nutritional anemia can also cause the decline of antibodies so easy to get sick due to infection and can cause fatigue, weak body, decreased capacity / ability or work productivity. Women of childbearing age are among the high risk groups to suffer from anemia because they do not have enough iron intake and reserves of iron requirement and loss. Whatever the cause, iron deficiency occurs slowly and ultimately this deficiency leads to low hemoglobin, myoglobin, and other iron compounds (Ramakhrishnan, 2003 dalam Utama, 2013).

Hemoglobin is a protein as carrier of oxygen in the blood and composed of simple proteins, namely globin and colored prosthetic radicals, called heme. These proteins are present in red blood granules and can be separated by centrifugation (Manuaba, 2001). Each liter of blood contains about 150 grams of hemoglobin. Levels of hemoglobin $K_3Fe_6(CN)_6$ will be converted to methemoglobin then converted to hemoglobin cyanide (HiCN) by KCN with severe threshold limit when Hb < 8 g/dL, mild anemia if Hb > 8-11 g/dL and normal in pregnant women If Hb > 11 g/dL (Manuaba, 2001). A man is classified to anemic when hemoglobin levels in blood amount < 13 g/%, women < 12 g/% and in pregnant women < 11 g/% (Mansjoer, 2000). Whereas according to Arisman (2007), the anemia incidence is defined as a condition in which the hemoglobin (Hb) level in the blood is lower than the normal value. The results were categorized into anemia (Hb < 12 mg/dL) and normal (Hb ≥ 12 mg/dL). The anemia incidence in women of childbearing age is still the largest public health problem in the world. In Indonesia, the prevalence of anemia among adolescents is 57.1 %, women of childbearing age 27.9 % and pregnant women 40.1 % (Ramakhrishnan, 2003 dalam Utama, 2013).

In addition to iron intake, hemoglobin is also influenced by the other factors, namely age, education level or knowledge of nutrition, cognitive function and habits (Sudikno dan Sandjaja, 2016; Palawe dan Rotty, 2016). Research on the relationship between the hemoglobin statuses with age in reproductive age women in the Yogyakarta province has not been done. Therefore, this study was conducted with the aim to determine the relationship of age with hemoglobin status in reproductive age women in the Yogyakarta Special Region province.

RESEARCH METHOD

This research was conducted an observational research with cross sectional approach (Sompie *et al*., 2015). The study was conducted in four districts and one municipality in Yogyakarta Province, namely Bantul, Kulonprogo, Gunung Kidul, Sleman and Yogyakarta with 321 reproductive age women as respondents.

Sosiodemografi data collection (age) is done through interview with reproductive age women. Anthropometric data was collection by measurements the body weight using weight scales with 0.1 kg accuracy and body height using microtoise with 0.1 cm accuracy. Nutritional status determination of reproductive age women was conducted using Body Mass Index (BMI) indicator. Measurement of hemoglobin level was done by HemoSmart GOLD Hemoglobin Screening System, for quantitative measurement of hemoglobin with range 7 g/dL to 24 g/dL (ApexBio, 2017).

The data was obtained averaged and tested statistics. Statistical test of the relationship between age and hemoglobin statuses of reproductive age women was performed using chi square test (Usman dan Akbar, 2000).

RESULTS AND DISCUSSION

Age Distribution and Nutritional Status of Reproductive Age Women

Respondents characteristics based on age including 4 persons <20 years (1.2%), 281 (50.9%) age 20-40 years, 35 people age 41-60 years (10.9) and 1 person Age > 60 years (0.3%) (Figure 1). Based on these data, it can be concluded that most of the respondents are reproductive age women with age 20 to 40 years.

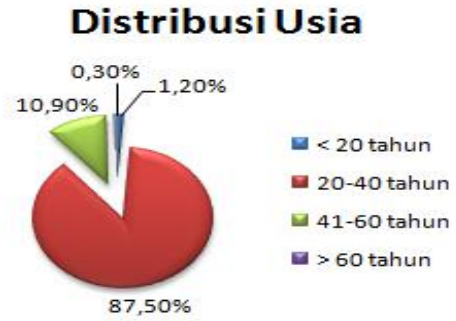

Figure 1. Age distribution of respondent

From 321 reproductive age women, 27 people with less nutritional status (8.4%), 120 people with normal nutritional status (37.4%), and the remaining 174 person with more nutritional status (54.2%). The nutritional status of reproductive age women who were respondents was dominated by more nutritional status (Figure 2).

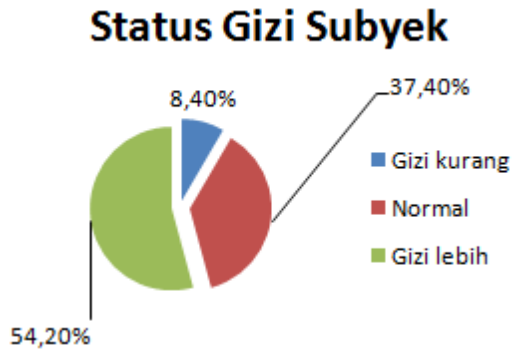

Figure 2. Nutritional Status of respondent

The nutritional status of reproductive age women in this study is shown by Body Mass Index (BMI). Body Mass Index is a very simple tool to monitor the nutritional status of adults especially those related to deficiency and overweight. Body Mass Index is a mathematical formula related to body fat and expressed as weight (kilograms) divided by high squares (meters) (Suliawati, 2013).

The BMI threshold category for Indonesians is <17 indicating severe body weight loss; 17-18,5 signifies mild body weight loss; 18.5-22.9 normal category; 23-24.9 indicates mild degree of excess body weight; > 25-29.9 indicates moderate overweight (obese I); > 30 indicates overweight weight (obes II) (Sirajuddin, 2012 dalam Suliawati, 2013).

When viewed from the distribution of nutritional status based on age, in women group <20 years no one is malnutrition and most of the nutritional status is normal. In the 20-40 years group (47.4 %) and 41-60 years (6.2 %) are more nutritional status, more than normal nutritional status. In the > 60 years group there is only one person and nutritional status is classified as over nutrition (Table 1). Thus, in this study most reproductive age women (54.2%) had excess nutritional status.

Table 1. Nutritional status based on age

Sample characteristic	Amount		Nutritional status (Body Mass Index)					
			Malnutrition		Normal		Over nutrition	
(Age)	n	%	n	%	n	%	n	%
< 20	4	1.2	0	0	3	0.9	1	0.3
20 - 40	281	87.5	26	8.1	103	32.1	152	47.4
41 - 60	35	10.9	1	0.3	14	4.4	20	6.2
>60	1	0.3	0	0	0	0	1	0.3
Total	**321**	**100**	**27**	**8.4**	**120**	**37.4**	**174**	**54.2**

Hemoglobin Status

The result of this study shown that 176 reproductive age women are less hemoglobin status (54.8%). More than half of reproductive age women have under-normal hemoglobin status and, as many as 145 people (45.2%) had normal hemoglobin status (Table 2), therefore can be said that 54.8% reproductive age women have anemia although the majority of respondents were more nutritional status. According to Tristiyanti (2006), the anemia status influence by education level, especially in selection of food. This is related by education about the nutrition of food consumed.

Table 2. Relationship between age and hemoglobin status

Hemoglobin status	Age (year)								Total		p
	<20		20 - 40		41 - 60		>60		n	%	
	n	%	n	%	n	%	n	%			
Less	3	0.9	153	47.7	19	5.9	1	0.3	176	54.8	0.68
Normal	1	0.3	128	39.9	16	5.0	0	0	145	45.2	

The anemia prevalence in Yogyakarta is high indicated by the hemoglobin status less than 54.8% of reproductive age women. Research conducted by Riset Kesehatan Dasar (Riskesdas) in 2007 showed that the percentage of anemia at reproductive age women in Indonesia did not get pregnant (≥ 15 years) in urban area was 19.7 percent (Departemen Kesehatan, 2007). Furthermore in 2013, the anemia percentage at reproductive age women (15-44 year) increase, amount 35.3 persen (Kementerian Kesehatan RI, 2013). According to Sudikno dan Sandjaja (2016), anemia is becoming a healthy problem especially in the poor householda with medium category. Furthermore, Sudikno dan Sandjaja said that in the reproductive age women (15-35 year) with less ferritin status have anemia risk of 4.01 time than the reproductive age women with sufficient ferritin status after being controlled by vitamin A status and age variables.

The factors that cause anemia in the population involve complex interactions of social, political, ecological, and biological factors (Balarajan *et al*., 2011). Nutritional factors that contribute to anemia are iron deficiency. This is because the consumption of foods that are monotonous, but rich in substances that inhibit the absorption of iron (phytates) so that iron can not be utilized by the body (Agrawal *et al*., 2006). Iron deficiency can also be exacerbated by poor nutritional status, especially when associated with a deficiency of folic acid, vitamin A or B12, as is often the case in developing countries (Kaur, 2014). The research had conducted by Pala dan Dundar (2008) in Turky shown that the long menstruasi also associated with anemia. Infectious diseases, malaria and worm infection are the cause of anemia, especially in endemic areas (Agrawal *et al*., 2006). In addition, the socio-economic conditions of households are also associated with the occurrence of anemia. Several studies show anemia incidence rates that tend to be higher in poor households (Sanku *et al*., 2010; Siteti *et al*., 2014).

Relationship between Age and Hemoglobin Status

The result of statistic test of the relationship between age and hemoglobin status of reproductive age women using chi square analysis obtained p value = 0.682, p>0.05 (Table 2) so there is no relationship between age with hemoglobin status in reproductive age women. The status of hemoglobin is not directly related to age. The age is associated with fatigue levels. The age older a people so the greater level of fatigue. The older a person, so the physiological function also decrease. This may be associated with hemoglobin levels in the blood. The directly factors related to hemoglobin levels lead to more biological and physiological factors. According to Palawe dan Rotty (2016), there was a significant relationship (p = 0.96) between hemoglobin level and cognitive function of elderly people and hemoglobin level with sleep quality (p = 0.75). In addition to age factor, intake of micronutrients such as vitamins and minerals is necessary to anemia prevent. The presence of other micronutrient deficiencies, including vitamins A and B12, folate, riboflavin, and copper can increase the risk of anaemia. Furthermore, the impact of haemoglobinopathies on anaemia prevalence needs to be considered within some populations (WHO, 2008).

CONCLUSION AND RECOMMENDATION

Based on the results of this study can be concluded that is no relationship between age with hemoglobin status in reproductive age women (p value = 0.682, p>0.05). Hemoglobin statuses are influenced by other factors so it is advisable to conduct research with other variables that may affect the hemoglobin status. In this study the determination of nutritional status was made with BMI indicator, for further research can also be combined with the upper arm circumferences indicator to be able to know the level of Chronic Energy Lack in reproductive age woman.

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THE RELATIONSHIP BETWEEN ENERGY INTAKE WITH NUTRITIONAL STATUS OF CHILDREN UNDER FIVE IN YOGYAKARTA SPECIAL PROVINCE

[1*)] Siti Dewi Indrasari , [1)] Titiek F. Djaafar , [1)] Tri Marwati, [1)] Retno Utami Hatmi, [2)] Toto Sudargo

[1)] Assessment Institute for Agricultural Technology of Yogyakarta, Indonesia
[2)] Department Nutrition and Heath, Faculty of Medicine, Gadjah Mada University, Indonesia

*) Correspondence email : dewindrasari@yahoo.com

Abstract

This study was an observational study with cross sectional study design that aims to determine the relationship of energy intake and nutritional status in children under five. The study was conducted in four districts and one municipality in Yogyakarta Province with total research subjects of 322 children under five. The study was conducted with anthropometric measurements such as weight and height for children under five as well as interviews with the mothers of the food consumption in the household to determine energy intake of children under five in relation to their nutrition status. The results of statistical tests of the relationship between energy intake with nutritional status of children under five using chi square analysis resulted in p value = 0.572, p > 0.05. It can be concluded that there was no correlation between energy intake with nutritional status of children under five .

Keywords : energy intake, nutrition status, children under five

INTRODUCTION

Malnutrition in children under five is a serious problem in developing countries due to the high mortality and morbidity with which is associated. They are particularly susceptible to the adverse effects of malnutrition as they are in a vulnerable growth period with high growth requirements (Blossner and de Onis, 2005). Malnourished child is estimated to be the largest contributor to global burden of disease, killing millions of children in the developing coubtries and causing substantial helath expenditures (Black *et al*., 2003; Ezzati *et al*., 2003, United Nation, 2004). It is estimated that 54% of deaths in children under five year are associated with malnutriton (Gordon *et al*., 2004). In children, malnutrition is synonymous with growth failure. Malnourished children are shorther and lighter in weight than the should be for their age (UNICEF, 2000).

The prevalence of malnourished children under five was high in the amount of 11.31 % in DI Yogyakarta Province in 2010. Whereas in 2011 the prevalence of malnourished children under five has decreased to 10.28 %. However, the prevalence of malnourished children under five in the province is still above 10 %, which means it is still above the threshold universal value of public health problem. While the prevalence of children under five with severe nutritional status in 2011 amounted to 0.68 % and the over nutritional status of 2.55 % . Although the number of malnutrition in the province have exceeded the national target but severe malnutrition was still found in DI Yogyakarta (Dinas Kesehatan Provinsi DI Yogyakarta, 2012) .

Malnutrition associated with calorie, protein, and micronutrients. Child survival is not only influenced by the availability of nutrients for the child but also for the mother. Nutrition and diet of the mother during pregnancy affects the weight babies birth, and during lactation affects the quantity and nutritional quality of breast milk (Badan Perencanaan Pembangunan Nasional, 2009) .

Nutritional problems can be experienced by all age groups. However, nutritional problems that occurred in the age group of children under five can not go unpunished. Because, at that time children under five is experiencing a maximum growth and development. The impaired growth and development of these things will affect physical endurance and intelligence so that they can have an

impact on life in the future. If the nutritional problems in children under five is not addressed will lead to a lost generation which is a dangerous situation for the survival of a nation. Therefore, it is important to assess the growth of children under five and its causes , including nutrition improvement starting from the family level (Suyanto , 2004) .

Nutrition is very important for the growth and development of children. Child development depends on many factors such as genetic, endocrine, autonomic nervous system and nutritional status. The first three factors certainly play important roles for cognitive development of children, while proper nutrition supplies necessary substances for maximisation of the potential development (Hop *et al*., 2009). Food consumption affect the nutritional status. Well nourish status when the body gets sufficient nutrients are used efficiently, thus allowing the physical growth, brain development, employability and general health at the highest possible level. Under nutrition status occurs when the body is deprived of one or more essential nutrients. Over nutritional status occurs when the body gets the nutrients in excessive amounts, causing hazards (Almatsier , 2006) .

RESEARCH METHOD

This study was an observational study with cross sectional study design . The study was conducted in five districts in Yogyakarta Province with research subjects totaling 322 children under five. The study was conducted with anthropometric measurements such as weight and height for children under five as well as interviews with the mothers of the description of food in the household to determine nutrient intake of the children under five. Interviews and measurements were performed 3 times on different days with each measurement for ± 30 minutes . This research was conducted in October 2014. The research instruments used include weight scales and height gauges. Intake data analysis using Nutrisurvey program. The statistical test used was chi square .

RESULTS AND DISCUSSION

The sample in this research were 322 children under five who were selected from five districts in Yogyakarta Special Province. The subjects was characterised by gender which consist of 158 boys (49.1 %) and 164 girls (50.9 %) (Figure 1) .

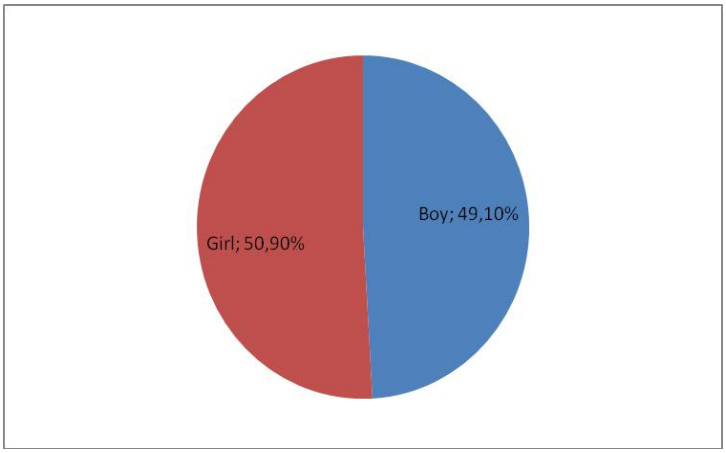

Figure 1. Subject Characteristics by Gender

Out of the 322 children under five, 4 of them with severe nutritional status (1.2 %) , 44 with under nutritional status (14 %) , 269 with well nourish status (83.5 %), and the rest as many as five children with over nutritional status (1.6 %) (Figure 2) .

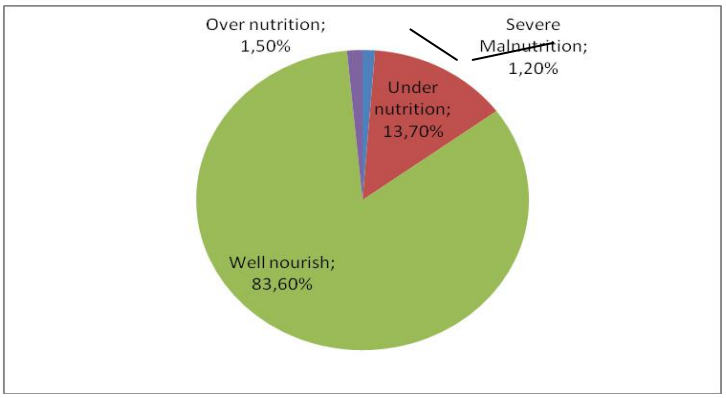

Figure 2. Children Under Five Nutritional Status

Based on the nutritional status by sex, the distribution of girls with well nourish nutritional status are more than boys. While children with severe nutritional status and under nutrition status are more in the group of boys than girls. Boys are also more well-nourished than girls (Table 1). Study in Mashhad, Iran reported that malnutrition in boys was more severe than in girls in the age range of 24 to 35 months. But, malnutrition in girls was more severe than in boys in the age range of 36 to 59 months (Shafieian *et al*., 2013). In a mountainous area of Northern Vietnam in 2012, the prevalence of underweight among children aged 24-59 months is estimated at around 20-25%; it peaked in summer (24.9%) and reached a low in winter (21.3%) (Huong *et al*. 2014).

Assessment nutritional status of children in this study using Weight for Age (W/A) indicator. The nutritional status indicator based on index of W/A gives indication of nutritional problem in general. This indicator does not provide indications of chronic or acute nutritional problems as weight is positively correlated with age and height. A low W/A indicator may be due to short (chronic nutritional problems) or is suffering from diarrhea or other infectious diseases (acute nutritional problems) (Kementerian Kesehatan R.I., 2013).

Table 1. Nutritional Status of Children Under Five Based on Sex in Yogyakarta Special Province in 2014

Sampel Characteristic	Total		Nutritional Status (W/A)							
			Severe Nutrition		Under Nutrition		Well Nourish		Over Nutrition	
	N	%	n	%	n	%	n	%	n	%
Sex										
Boys	158	49.1	3	1.9	23	15	128	81	4	2.5
Girls	164	50.9	1	0.6	21	13	141	86	1	0.6
Total	322	100	4	1.2	44	14	269	83.5	5	1.6

Weight loss is one measure that gives an overview tissue mass, including body fluids. Weight loss is very sensitive to sudden changes either because of infectious diseases as well as decreased food consumption . Body weight is expressed in index form BB/U (Weight by Age) or assessed by

looking at changes in body weight at the time of measurement is made, which in use gives a picture of right now (Djumadias , 1990 in Ridian , 2012).

Under normal circumstances , where a state of good health and a balance between consumption and nutrient requirements is assured, then weight developed following the increase of the age. Conversely in abnormal circumstances , there are two possibilities for the development of weight that can progress faster or slower based on weight for age which is used as one measurement of nutritional status. Weight characteristics to be unstable because it is easy to change so that better describe the current nutritional status of a person (Ridian , 2012) .

Energy intake in 172 children under five classified as less (53.4 %). While the children under five with sufficient energy intake by 77 children (23.9 %) and total over energy intake were 73 children under five (22.7 %) (Table 2)

Table 2. Distribution of Nutritional Status based on energy intake

Variable	Nutritional Status (W/A)								Total		P
	Severe Malnutrition		Under Nutrition		Well Nourish		Over Nutrition				
	n	%	n	%	n	%	n	%	n	%	
Energy Intake											
Less	3	0.9	24	7.5	142	44.1	3	0.9	172	53.4	
Normal	0	0	13	4	64	19.9	0	0	77	23.9	0.572
Over	1	0.3	7	2.2	63	19.6	2	0.6	73	22.7	

The statistical tests of the relationship between energy intake with nutritional status of children under five using chi square analysis resulted in p value = 0.572 , p > 0.05 (Table 2), so that there is no relationship between energy intake with nutritional status of children . This is in line with the results of Natalia *et al.* (2013) reported that there is no relationship between the level of energy intake and the nutritional status of children under three in the village of Gondangwinangun, Temanggung, Central Java in 2012. The prevalence of underweight, wasting and stunting of children under five in food insecurity area in Banjarnegara district, Central Java not related to the level of energy and protein intake of children under five (Fauziah, 2009).

Table 2 shows that the prevalence of severe malnutrition and under nutrition in children under five with less energy intake up to 14.9%. This figure is still below the prevalence of severe malnutrition and under nutrition nationally that is 19.6% and still below the Millennium Development Goal (MDG) 2015 amounted to 15.5%. Yogyakarta Special Province is not included in 18 provinces with prevalence of malnutrition over the national prevalence rate ranging from 21.2% to 33.1% (Kementerian Kesehatan R.I., 2013).

Based on an analysis using chi-square the p value = 0.572 where the value of p > 0.05 so there was no correlation between energy intake with nutritional status of children. This means that both energy intake whether is less, sufficient, and excess does not affect the nutritional status of children directly. From these results can also be concluded that infants with less energy intake, sufficient or excessive likely to have less nutritional status , either , nor excessive equally.

Nutrients are chemical elements contained in food that is necessary for normal metabolism in the body. Nutrients that the body need such as carbohydrates, fats , proteins , vitamins, minerals, and water. Nutrients that have been consumed will be used by the body to achieve optimal nutritional status (Almatsier , 2006) .

Energy in the human body arises due to the burning of carbohydrates, protein, and fat. Thus in order to be fulfilled the energy required, the body needs a quite well of a nutrient intake. The amount of energy a person needs depends on age, sex , weight, and body shape (Muchlis , 2011) . Study in

Dagoretti, Nairobi, Kenya reported that children who took adequate energy had a lower risk of being underwight than those who took inadequate energy. Children who had four or more varieties of food had a lower risk of under weight than those who took less than four varieties of food (Mwaniki and Makokha, 2013). According to Huong *et al*. (2014) the energy intake among children 24-59 months in mountanious area of Northern Vietnam was highest in the autums (1259.4 kcal) and lowest in the summer (996.9 kcal) in 2012.

The nutritional status of the children under five are not only influenced by energy intake, but also many other factors, so it may not be directly related to energy intake and nutritional status. Factors that influence the nutritional status of children including the family economic factors affecting diet and nutritional intake of children; socio-cultural factors that places the interests of pregnant women and nursing mothers after the interests of the father as the head of the family, and children, educational factors are generally low so that the impact on the mother very limited knowledge about healthy lifestyles and the importance of nutrition for health and nutritional status of children.

Furthermore, according to Arisman (2004) in Devi (2010) , nutritional status is affected by the determinant biological include gender, the environment in the uterus , the number of births, birth weigh , the size of the parents, and the constitution of genetic and environmental factors such as socio-economic situation of the family.

CONCLUSION AND RECOMMENDATION

From the analysis using chi square analysis the p value = 0.572 so that it can be concluded that there is no relationship between energy intake with nutritional status of children .

Many factors affect the nutritional status of infants that need to be carried out with other variables that may affect the nutritional status of children in addition to energy intake. To determine nutritional status indicators can be used others indicator aside of the Weight by Age .

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IMPACT GOVERNMENT POLICY TOWARD COMPETITIVE OF SHALLOT COMMODITY IN BANTEN PROVINCE

Viktor Siagian

Assessment Institute for Agricultural Technology of Banten, Indonesia

Correspondence e-mail : viktorsiagian@pertanian.go.id

Abstract

The goal of this study were: 1) Analyze the competitiveness of shallot commodity in the province of Banten, 2) Analyze of impact government policy toward shallot competitiveness in the province of Banten, Method of study using survey methods, with simple random and purposive sampling at the farm level. Methods of data analysis using qualitative and quantitative analysis. Qualitative analysis using descriptive tabulation. Quantitative analysis using the Policy Analysis Matrix. The results of this study are: 1) The value of PCR (Public Cost Ratio) ratio namely 0.390 means that shallot has a moderate competitive advantage, DRCR (Domestic Resources Cost Ratio) Ratio namely 0.400 means that shallot has a moderate comparative advantage, 2) The 20% tradable input price increase on shallot farming will reduce the PCR value by 0.5% while the value of DRCR has not changed. The conclusion that red shallot commodity has a relatively moderate competitiveness value.

Keywords : Competitiveness, farming, shallot, Policy Analysis Matrix.

INTRODUCTION

Shallot planting area in 2015 year with an area of 112 ha with production of 686.7 tons or with productivity of 6.13 tons per ha (CBS, Banten in Figure 2016). Based on the existing harvested area, 97 ha (86.6%) are found in Serang District with production 625.2 tons (91.0%), and the rest in Tangerang District with production of 4.8% or 33 tons and Pandeglang District with production of 29.3 tons or 4.2%. The area of harvest in Serang District mostly in Kramatwatu Subdistrict with harvested area 86 ha (88,6%), Cikeusal Subdistrict namely 8 ha (8.2%) and the rest in other sub-districts (CBS, Serang District in Figure 2016.2106). The development of shallot harvest is fluctuated every year in Banten, in the period of 2011-2012 there is an increase of harvested area from 102 ha in 2011 to 202 ha in 2013 (increasing up to 98.0%), but in the period 2014 -2015 there was a decrease from 208 Ha to 112 ha (decreased 46.1%). This is due to fluctuating prices and pest attacks.

Competitive advantage is defined as the ability of a commodity to compete in the national/international market financially, while the comparative advantage is the ability of a commodity to compete in the national/international market economically/ socially. Competitive advantage is also called PCR (Private Cost Ratio) and the value must be <1 in order to have competitive advantage, while comparative advantage is also called DRCR (Domestic Resources Cost Ratio) and the value also must be <1 in order to have comparative advantage (Pearson S., 2003; Haryono D., et al, 2011; Rum M., 2010). The lower/smaller the second value mentioned above then the higher the farming competitiveness or more efficient.

From the results of Saptana study, et al, (2002) in Brebes District-Central Java Province and Simalungun District - North Sumatra Province for shallot commodity is known that both in Brebes and Simalungun District have a fairly high comparative advantage, each with DRCR coefficient of 0.49 and 0.51, and also has a competitive advantage with a coefficient value of PCR 0.40 and 0.50. To know how far the competitiveness of shallot commodity in Banten Province, it is necessary to conduct a deep study.

RESEARCH METHODS

Location and Time of Execution

The assessment was conducted in Banten province. The location of this study was conducted in two districts of shallot main production namely: 1) Serang District, and 2) Tangerang District. This time period study is for a year starting January 2015 - December 2015 (Siagian, et al, 2016).

Implementation Method of Assessment

The method used in this study is the survey method. The survey method was conducted for primary data collection using interview method using structured questioner toward farmer respondents. To obtain price data of import/export shallot parity price, freight cost and price at the retailer level to wholesaler or vendor at province level, then the survey is done from the nearest port to retailer. This study uses the port cost data and transport costs of the previous year, adjusted for inflation.

From each sample district, one representative sub-district was chosen and each sub-district selected several representative sample villages. From Serang District selected by simple random sampling 50 respondents and from Tangerang District was chosen by purposive 30 respondents according to proportional area of harvest and production amount in both districts. Besides the survey method is also collecting secondary data in related institutions to obtain supporting data**.**

Processing and Analyses of Data

Data analysis used is qualitative and quantitative analysis. Qualitative analysis is used for descriptive tabulation analysis. Quantitative analysis uses Policy Analysis Matrix (PAM) to know competitive advantage and competitiveness of shallot commodity. The PAM approach is based on two sets of commodity budgets that one uses the financial/private (market) price and the other using the social/economic price (Pearson S., 2003). The general form of PAM is as follows ;

Table 1. Table Policy Analysis Matrix

Revenue	Cost		Profit
	Input tradable	Input domestic	
Private			
A	B	C	D = A – (B + C)
Social			
E	F	G	H = E – (F +G)
Divergences			
I = A-E	J = B – F	K= C- G	L = D - H

Source: 1) Pearson S., Policy Analysis Matrix, Stanford Unversity, 2003.
2) Monke and Pearson, 2004 in Haryono D., 2011.
3) Pearson S., et al, 2004, Applications of The Policy Analysis Matrix in Indonesian Agriculture. Yayasan Obor Indonesia, Jakarta.

Where:
A = Receipts in private/market/financial prices.
B = Tradable (internationally tradable) input costs in private prices
C = Domestic factor costs in private prices.
D = Profit in private price = Private gain.
E = Revenue in social prices
F = Tradable input costs in social prices
G = Domestic factor costs in social prices
H = Profit in social price = social profit

1. Competitive Advantage (PCR) and Comparative (DRCR)

A. Private Cost Ratio (PCR) = C / (A-B): If PCR <1, then there is a competitive advantage.
B. Domestic Resource Cost Ratio (DRCR) = G/(E - F): If DRC <1, then there is a comparative advantage (Pearson S., et al., 2004; Rum M., 2010; Haryono D., et al, 2011; , et al, 2012):

Analysis of Shallot Competitiveness in Banten Province

Based on the enumeration result, the average productivity of shallot in Banten Province at RS 2015/2016 is 6.050 ton per ha. With an average harvest price of IDR 13.907 per kg, the revenue is IDR 84.14 million per ha. Total Cost of Production IDR 35.32 million per ha to obtain Revenue IDR 48.82 million per ha. Based on analysis of B/C ratio is known value 1.4 at financial price. This means that shallot farming is financially profitable.

RESULT AND DISCUSSION

Characteristic of Respondents and Farming Patterns

Of the enumeration results, it is known for the Province of Banten that the average age of respondents is 48.2 years with a range of 20 - 72 years. The average education duration is 7.1 years (equivalent to grade 1 of Junior High School) with a range of 0 - 12 years. The area of exploited land in Rainy Season (RS) 2015/2016 averaged 0.32 ha with a range of 0 - 3.0 ha. The average of owned land area is 0.23 ha with a range of 0 - 3.0 ha. Total non-owned land averages 0.60 ha with a range of 0 - 14 ha. Most planting pattern is shallot - shallot - fallow. The dominant varieties cultivated are Bima Curut, Bima Brebes, and Maja.

Table 2. Analysis of Shallot Farming per Ha on RS 2015/2016 in Banten Province

Number.	Type of Input/Output	Volume	Price/unit (IDR)	Value (IDR)
1.	Seeds (kg)			
	a. certified	1089	17738	19316682
	b. non certified	107	16062	1718634
2.	Fertlizer (kg):			0
	a. Urea	138	2701	372738
	b. SP-36	206	2877	592662
	c. KCL	28	9234	258552
	d. ZA	42	1880	78960
	e. NPK Ponska	192	2743	526656
	f. NPK Mutiara	82	9871	809422
	g. Manure Fertilizer	1261	605	762905
	h. Organic Fertlizer (kg)	80	3570	285600
	i. Organic Fertlizer (ltr)	3.8	468	1778
	j. Solid Leaf Fertilizer (kg)	25	6612	165300
	k. Fluid Leaf Fertilizer (ltr)	2.1	62425	131093
3.	Solid Growing Stimulants (kg)	1.2	30000	36000
	Liquid Growing Stimulants (ltr)	0.1	83125	8313
4.	Pesticide:			
	a. Solid (kg)	17.7	31657	560329
	b. Liquid (ltr)	2.4	56046	134510

5.	Herbicide:			
	a. Solid (kg)	0	0	0
	b. Liquid(ltr)	1.7	200356	340605
6.	Other:			0
	a. Tax of building and land			0
	b. Contribution of irrigation Water Fee			0
	c. Contribution of Village			0
	d. Rent of water pump and others			172739
7.	Cost of Hired Labour :			
	a. Hired labour (Man Day Work)	123.4	72587	8957236
	b. Family Labour (Man Day Work)	30	0	0
	c. Wage of Livestock Service	0	0	0
	d. Wage of Tractor Service	0.16		85034
8.	Total Cost	0		35315748
9.	Revenue	6050	13907	84137350
10.	Income			48821602
11.	R/C			2.4
12.	B/C			1.4

Sourcee : Processed primary data, 2016 year.
Explanation : n = 62 respondents.

Shadow Price Determination

Price Shadow Output

The price of output shadow (shallot) is determined based on the border price at the nearest port, which is Tanjung Priok Port. For shallot commodity because it is net importer then the price of shadow is import parity price, and US $ currency converted with rupiah or Indonesian Domestic Rupiah (IDR), then minus freight cost from Tanjung Priok port to Serang City, and cost of transport from Serang City to farmer, processing fee, so as it is obtained social price shallot (output) at farmer level, shallot commodities are also imported which mostly come from Southeast Asia Nations (ASEAN). Based on data from the Ministry of Trade obtained the average price of shallot import (f.o.b) ASEAN export ports of US $ 994.35 per metric ton. The cost of freight and insurance from ASEAN seaports amounts to 1.53% (Ministry of Trade, 2015) and the rupiah exchange rate to US dollars on average in 2016 is IDR 13,600 per US. The value of CIF Indonesia after multiplied by US $ obtained the value of CIF Indonesia at the domestic price of IDR 13,756.4 per kg. Then after added with port handling cost (port loading and unloading) that is IDR 38.5/kg for dry bulk goods (Indonesian Port I, 2015). Then the cost of import tariff shallot 5% (IDR 680 per kg), transportation cost IDR 170 per kg according to survey result 2015 , Then in 2016 plus an average inflation cost of 3.5% (Bank of Indonesia, 2017) to be IDR 176 per kg, depreciation, and the cost of sack to the trader obtained the price of import parity IDR 14.793. The details are listed in Table 3 below.

Table 3. Calculation of Import Parity Price of Shallot (Social Price) at Farmer Level

No.	Item	Value (US$ or IDR)
1.	F.o. b. ($/ton)	994,35
2.	Freight Cost (%)	1,53%
3.	Insurance cost (%)	0,1951%
4.	C.i.f. of Indonesian ($/ton)	1,011.5
5.	Exchange rate (IDR/$)	13,600
6.	Exchange rate premium (%)	0
7.	Equilibrium exchange rate (IDR/$)	13,600
8.	C.i.f Indonesia at domestic price (IDR/ton)	13,756,400
9.	Factor of weight conversion (kg/ton)	1.000
10.	C.i.f. Indonesia at domestic price (IDR/kg)	13,756
11.	Port handling	38.5
12.	Cost of import tariff (5%)	688
13.	Cost of handling and transportation to wholesaler (IDR/kg)	176
14.	Value of shallot before processing (IDR/kg)	14,612
15	Conversion factor	1
16.	Cost depreciation and sack (IDR/kg)	152
17	Profit margin of wholesaler	500
18.	Price of import parity (IDR/kg)	14,643
19.	Transportation cost to farmers (IDR/kg)	152
20.	Price of Import Parity at farmer level	14,752

Source: Processed data, 2016 year.

Input Shadow Price

The price of Urea shadow fertilizer as an export commodity is then used export parity price. The average price of Urea fertilizer export (f.o.b) according to survey results to PT. Fertilizer Indonesia is US $ 287 per US $, with the exchange rate of rupiah to US $ 13,600 per 1 US $, the price of CIF Indonesia at the domestic price of IDR 3,903.2 per kg and the cost of port handling (loading and unloading service) for bulk commodity Dry IDR 38.5 per kg and transportation costs to wholesalers obtained import parity price IDR 4,117.7 per kg, and after added transportation costs to farmers obtained import price parity at the farm level IDR 4,269.7 per kg. The cost of freight and insurance is burned by the importing country because it is sold aboard the Tanjung Priok export port (f.o.b).

Table 4. Calculation of Export Parity Prices of Urea (Europe) at the Level Farmers of 2016

Number	Items	Value (US$ or IDR)
1.	F.O.B of Indonesian/Tanjung Priuk ($/ton)	287,0
2.	Exchange rate (IDR/$)	13,600
3.	Exchange rate premium (%)	0
4.	Equilibrium exchange rate (IDR/$)	13,600
5.	C.i.f Indonesia at Domestic Price (IDR/ton)	3,903,200
6.	Factor of weight conversion (kg/ton)	1.000
7.	C.i.f. Indonesia at domestic price (IDR/kg)	3,903,2
8.	Port handling	38,5
9.	Custom (import tariff)	0
10.	Cost of handling and transportation to wholesalers (IDR/kg))	176
11.	Price of Import Parity (IDR/kg)	4,117.7
12.	Transportation Cost to famers (IDR/kg)	152
13.	Price of Import Parity at Famers level	4,269.7

Source: Processed primary data, 2016.

Similarly, the export parity price of SP-36 as export goods is used f.o.b price, with an average price of 341 US $ per metric ton according to survey results to Indonesian Fertilizer Corporation. The method of calculation is the same as the calculation of export parity price of Urea, as shown in Table 5 below. Export parity price at farmer level according to calculation result is IDR 5.004,1 per kg.

Table 5. Calculation Export Parity Price of SP-36 (Europe) at farmer Level on 2016 Year

No.	Item	Nilai (US$ or IDR)
1.	F.O.B of Indonesian/Tanjung Priok ($/ton)	341,0
2.	Exchange rate (IDR/$)	13,600
3.	Exchange rate premium (%)	0
4.	Equilibrium exchange rate (IDR/$)	13,600
5.	F.O.B Indonesia at Domestic Price (IDR/ton)	4,637,600
6.	Factor of weight conversion (kg/ton)	1.000
7.	F.O.B Indonesia at Domestic Price (IDR/kg)	4,637.6
8.	Port handling	38.5
9.	Custom (tariff import)	0
10.	Cost of handling and transportation wholesalers (IDR/kg)	176
11.	Price of Import Parity (IDR/kg)	4,852.1
12.	Transportation Cost to famers (IDR/kg)	152
13.	Price of Import Parity at Famers level	5,004.1

Source: Processed primary data, 2016.

The determination or calculation of the export parity price of NPK fertilizer is also the same as the previous two fertilizers. The details are listed in Table 6 below. From the calculation result obtained parity price of NPK fertilizer export at farmer level IDR 4,684,5 per kg.

Table 6. Calculation of Export Parity Price of NPK (Europe) at Farmer Level on 2016 Year

Number.	Item	Value (US$ or IDR)
1.	F.O.B Indonesia/Tanjung priuk ($/ton)	317.5
2.	Exchange rate (IDR/$)	13,600
3.	Exchange rate premium (%)	0
4.	Equilibrium exchange rate (IDR/$)	13,600
5.	FOB Indonesia at domestic price (IDR/ton)	4,318,000
6.	Factor of weight conversion (kg/ton)	1,000
7.	FOB Indonesia at domestic price (IDR/kg)	4,318,0
8.	Port handling	38.5
9.	Custom (import tariff)	0
10.	Cost of handling and transportation to wholesalers (IDR/kg)	176
11.	Price of Import Parity (IDR/kg)	4,532.5
12.	Transportation Cost to famers (IDR/kg)	152
13.	Price of Import Parity at Famers level	4,684.5

Source: Processed primary data, 2016.

Analysis of Shallot Competitiveness in Banten Province

Based on the enumeration result, the average productivity of shallot in Banten Province on RS 2015/2016 is 6,050 ton per ha. With an average harvest price of IDR 13,907 per kg, the revenue is IDR 84.14 million per ha. Total Cost of Production IDR 35.32 million per ha to obtain Revenue IDR 48.82 million per ha. Based on analysis of B/C ratio is known value 1.4 at financial price. This means that shallot farming is financially profitable.

Based on the above, the Table of Input-Output of shallot farming based on tradable goods (international tradable goods and non tradable goods) can be compiled. Based on the Table 7 below,

the B / C ratio is based on the financial price or the market price is 1.4 and the value of B/C ratio based on the social price is 1.5 meaning that the shallot farming is profitable financially and socially (without any market distortion from the government).

Table 7. Table Input – Output Tradable Goods and Non Tradable Goods Shallot Farming on RS 2015/2016 in Banten Province

	TYPE OF INPUT- OUTPUT			PRICE (IDR)/UNIT		VALUE OF INPUT-OUTPUT (IDR)	
Number	Tradable Goods	Non Tradable Goods	Volume	Financial	Social	Financial	Social
1		seeds(kg)					
		a. certified	1089	17734	17734	19316682	19316682
		b. non certified	107	16062	16062	1718634	1718634
2	Fertilizer (kg):						
	a. Urea		138	270	3982.1	372738	549530
	b. SP-36		206	2877	4763.3	592662	981240
	c. KCL		28	9234	5400	258552	151200
	d. ZA		42	1880	3400	78960	142800
	e. NPK Ponska		192	2743	4372.5	526656	839520
	f. NPK Mutiara		82	9871	10600	809422	869200
		f.Manure Fertilizer	1261	605	605	762905	762905
	g. Organic fertilizer (S)		80	3570	3570	285600	285600
	h. Organic fertilizer (f)		3.8	468	468	1778.4	1778
	i. Solid Leaf fertilizer (kg)		26	6612	19110	171912	496860
	j. Fluid Leaf Fertilizer (ltr)		2.1	62245	62245	130715	130715
3	a. Liquid Growth Stimulan	(ltr)	0.1	83125	8199	8313	820
	b. Solid Growth Stimulan	(kg)	1.2	30000	30000	36000	36000
4	Pesticide:					0	0
	a. Solid (kg)		17.7	31657	31657	560329	560329
	b. Liquid (ltr)		2.4	56046	56046	134510	134510
5	Herbicide:						0
	a. Solid (kg)		0	0	0	0	0
	b. Liquid (ltr)		1.7	200356	200356	340605	340605
6							0
		A Tax of building and land.				0	0
		b. Water irrigation fee.				0	0
		c. Contribution to village				0	0
		d. Hired of water pump				0	0
		Cost of Hired labour:					
		a.Hired labour (WMD)	123.4	72587	72587	8957236	8957236
		b.Family Labour (WMD)	30	0			0
		c. Wage of Livestock Service	0	0		0	0
		d. Wage of Tractor Service	0.16			85034	85034
7			0			35149243	36361198
8	Revenue		6050	13907	13673	84137350	82751900
10	Income					48988107	46390702
11	R/C					2.4	2.3
12	B/C					1.4	1.3

Source : Processed primary data, 2016.
Explanation : n = 62 respondents. WMD = Work Man Day.

Policy Analysis Matrix of Shallot Farming

From Table Input-Ouput Tradable Goods and Non Tradable Goods then can be compiled Table Policy Analysis Matrix namely Table 8 as below.

Table 8. Policy Analysis Matrix of Shallot Farming on RS 2015/2016 in Banten Province

Revenue	Tradable Input	Domestic Input	Profit
A	B	C	D
Financial	Financial	Financial	Financial
84,137,350	5,071,657	30,840,491	48,225,202
E	F	G	H
Social	Social	Social	Social
89,497,650	6,432,810	30,840,491	52,224,350
Divergence			
-5,360,500	-1,361,153	0	-3,999,147

Source: Primary data, processed, 2016 year.

Of the calculation result of PAM analysis known that the value of PCR (Public Cost Ratio) or Private Ratio 0.39 means that shallot commodity has competitive advantage, so to produce one unit of production at financial or private price required 0.39 cost of domestic financial input.

Table 8. Calculation Result of PAM for Parameter Analyzed

Number.	Parameters	Rumus	Nilai Besaran
1.	Competitiveness:		
	a. PCR	C/(A-B)	0.390
	b. DRCR	G/(E – F)	0.403
2.	Profit Analysis:		
	a. Private Profitability (PP)	D = A – (B+C)	IDR 48,225,202
	b. Social Profitability (SP)	H = E – (F + G)	IDR 45,627,797
3.	Output Policy:		
	a. Output Transfer (OT)	A – E	IDR 1,385,450
	b. NPCO	A/E	1.02
4.	Input Policy:		
	a. Input Transfer (IT)	B – F	IDR -1,211,955
	b. NPCI	B/F	0.81.

Source: Processed primary data, 2016.

The value of DRCR (Domestic Resources Cost Ratio) or 0.40, means that shallot farming has a comparative advantage, meaning that to produce one unit of production at a social price requires only need 0.40 cost of domestic resources at social prices. The smaller the value of both means the higher of the amount of competitiveness.

Based on the profit analysis, it is known that shallot commodities provide profit on the financial cost (Private Profitability/PP) of IDR 55,380,453 per ha, and profit based on social price (Social Profitability/SP) of IDR 114,848,523, meaning either with or without government intervention on the market of shallot commodities can provide profit.

Based on the analysis of output policy, obtained value of Output Transfer (OT) of IDR -61,846,995, meaning that there is no subsidy on the output of shallot from the government to producers/farmers. This is supported by other parameters is NPCO (Nominal Protection Coefficient on

Output) of 0.55 value, that is because NPCO <1, it means that shallot farmers do not accept protective policy from government (there is no subsidy output).

Sensitivity analysis that aims to see how the results of an economic activity analysis if there is a change in the calculation of costs or benefits. This study use simulasion, namely assumption of input changes are increase in tradable input prices by 20%. The simulation results are listed in Table 9 below.

Table 9. Sensitivity Analysis if Price of Tradable Input Increase 20% at Shallot Farmer

Number	Indicators	Initial Value	Price of Tradable Input is increase 20%	Increase/ Decrease (%)
1	PCR	0.390	0.395	+ 0.5
2	DRCR	0.403	0.403	0
3	PP	48,225,202	47,210,871	- 2.1
4	SP	45,627,797	46,256,158	+ 1.4
5	OT	1,385,450	1,385,450	0
6	NPCO	1.02	1.02	0
7	IT	-1,211,955	-197,624	+83.7
8	NPCI	0.81	0.97	+ 19.7

Source: Processed primary data, 2016.

Based on the above table, the 20% tradable input price increase will raise the value of competitive advantage (PCR) by 0.5% or decrease the competitive competitiveness value by 0.5%. The value of comparative advantage (DRCR) remains fix due to changing only tradable input prices. Private Profitability rose by a very small 0.91% while social profit fell sharply by 183.3%.

Output transfers do not change as financial prices and quantities of output are unchanged. Similarly, the Output Coefficient Protection Value (NPCO) does not change as only the tradable inputs are changed. While Input Transfer increase up 83.7% showed no transfer from tradable input producers (fertilizer, pesticides) to farmers, precisely the opposite. For Input Coefficient Protection Value (NPCI) increase up 19.7 and the value less than 1 means there are still relatively small policies that are protective of inputs.

CONCLUSION

1. The area of cultivated land of shallot farming in the rainy season 2015/2016 averages 0.32 ha. The dominant varieties are Bima Brebes, Bima Curut and Maja. Average productivity of 6.05 tons per ha. Value of B/C ratio is 2.8, so shallot farming is profitable.
2. Value of PCR (Public Cost Ratio) is 0.39 means that shallot commodity has moderate competitive advantage, the value of DRCR (Domestic Resources Cost Ratio) is 0.40, it means that shallot farming has a comparative advantage (DRCR value <1) is moderate . In conclusion, shallot commodity has a relatively moderate competitiveness.
3. The increase of tradable input price of 20% on shallot farm will decrease competitive competitiveness value (PCR) of 0.5% while the value of comparative competitiveness (DRCR) has not changed.
4. It is suggested to increase the competitiveness of shallots, it is necessary to increase the productivity of shallot through the application of cultivation technology.

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DEGENERATION OF FARMERS IN BANTEN: A CRITICAL ETHNOGRAPHIC CASE STUDY OF SAWARNA VILLAGE IN LEBAK REGENCY

[1*)] Abdul Hamid, [1)] Riswanda, [1)] Yeni Widyastuti

[1)] Faculty of Social and Political Science University of Sultan Ageng Tirtayasa, Indonesia

[*)] Correspondence e-mail: abdul.hamid@untirta.ac.id

Abstract

This research was conducted to get better understanding about degeneration of farmers in Banten Province, by a case study in Sawarna Village. The village was chosen because it is one of the villages having the highest food reserves in Banten Province. The method used in this study is critical ethnography, seeing farmers and agriculture as a marginalised sector. Agriculture in Desa Sawarna faces two challenges at once, particularly regarding the shifting of the farmers professionals and the farming land conversion. Firstly, the emergence of a large cement factory in Bayah District where Sawarna Village is located requires large areas for mills and mining industries for natural resources. The emergence, to some extent, lead farmers to leave their lands for labouring. Secondly, the tourism sector in the village of Sawarna is growing rapidly and seems to have been seen more economically promising than the agricultural sector. These two things together with the development of a toll road from Serang to Panimbang, breaking the isolation of the southern region of Banten, creates urbanization issues of the local farmers in the village. Agricultural lands in the Sawarna village appears to have been bought by a land speculator company. This study makes the case that the transfer of land ownership from farmers to private companies could destroy the agricultural sector in Sawarna.

Keywords: Degeneration, marginalisation, land conversion

INTRODUCTION

This study is making the case that Indonesia has lost a generation of farmers in the agricultural rice production. The term 'degeneration' of farmers used in the paper is defined as a way to explain how rice farmers leave their lands and in actual fact could be influenced by multilayers aspects which in turn make the degeneration issue is systemic. To some extent, the underlying aspects are complex and multilayered in nature. A critical ethnographic case study was conducted in Sawarna Village, famous for its reputation as granary for Banten Province located in West Part of Java Island, Indonesia.

In general, Indonesian farmers today can be landless. The prolong impact of the global financial crisis, started in 1997 has collapsed barely the whole economy, driving thousands of unemployed construction and industry workers back to the villages, where their families already had difficulties making ends meet. The current situation raises worrying situations on some devastating fronts. The most noticeable change is the increased pressure on agricultural land. Thousands of small farmers have been evicted from the fields they have cultivated for generations, because local or national authorities are giving concessions to large companies to exploit their land they have been inhabited for generations. They are replaced by large plantations, including palm oil and rubber plantations, food estates, mines, roads and other infrastructure projects. This results in increasingly violent land conversion and in turn put local farmers at crisis.

The provincial government of Banten routinely prioritizes large-scale, export-oriented production over the needs of local growers and consumers. The regional policy has accelerated this dramatic land grab as farmland is now seen by the finance industry as a considerable source of returns. Instead of protecting local farmers from massive evictions, the Indonesian government is further opening the doors to foreign investors. The idea is to increase food productivity in Indonesia.

However, as it may happen nationally, the province also has to cope with uncertainty about commodity prices, instead of producing for export and filling in the local market, prices have become unpredictable. According to the local farmers in Sawarna, prices of seeds, fertilizers and energy have become very volatile, making it impossible for them to assess our production costs. For farmers, price instability and volatility are worse than simply low prices: It makes it virtually impossible to plan what to grow in the coming season, other than having to deal with catastrophe of plant hoppers and massive palm oil invasion, lack of food reserves and the arrival of foreign financial speculators in agricultural markets. Imported rice for instance is likely cheaper than local product in the domestic market.

At Sawarna, the multilayered aspects mentioned formerly discourage farmers from producing, ultimately raising unemployment, encouraging more people to migrate away from the village, resulting in a paradigm shift of farming production. The shift starts what the study terms as 'de-generation'. Global climate change impacts, to some extent, the natural-traditional farming production such as unpredictable weather/climate prediction. This issue comes along with natural farming harmful epidemic such as "hama wereng" in Bahasa, can damage the growth of the rice and even destroys the production whatsoever. The existing policy solution for the governmental for the government seems to relate with non-budgetary action like the anti-dots for "hama wereng". Massive used of pesticide has make it immune for the pest "hama wereng" to the degree where the pest is no longer controlled by the pesticide. The exploitation of land used for "pajale" (padi-jagung-kedelai) for long period without any break, suggested bya the Indonesian government may have damaged the soil fertility to a large degree.

Furthermore, the Provincial Government of Banten applies centralistic farming technological supports appears to have worsen the situation to a large extent. For example, the national strategic policy once insisted on producing soybean and corn, whilst the land in Sawarna could not grow. The strategy requires farmers with knowledge of technological production that rural farmers do not have. Central government stresses out one policy solution suits all issues, whilst farming is very much contextual with nature. The issues influencing the policy solution are unmatched statistical data statistic between Village Government and District Government with which makes it even difficult come up with evidence-based policies. As an instance, no proper data is found regarding agricultural demographic in the village in determining policy actions that might improve local agricultural production

Literature Review

In most Indonesian rural areas generally, agricultural-based food productions are centered in villages wherein the majority of the villagers work as farmers (Utoyo 2014, p. 2). Whilst generating incomes from agricultural food production, Indonesian farmers are likely dependent of the changing condition of their natural surroundings such as climate changes and natural resources (Landis 2014, p. 233). Indonesian Directorate General of Rural Development (cited in Nelson and Seokanto, 234-236) revealed that farming is a predominant income earnings in Indonesian villages.

Rural community security strategy can be said as Coping Strategy dan Adaptive Strategy (Daryanto,et.al, .2011:77). Coping strategy is defined as strategies by a rural community in coping with unpredictable climate changes like, whilst adaptive strategy is the way the community can survive economic crisis. The strategies can be exemplified as to intensifying farm lands by capital supports and labour intensive. Another sub-strategy is to do non-farming jobs in addition to the existing farmlands. The second can be a way to provide alternative incomes in hard times where farmlands are in crisis. Last sub-strategy could by temporarily or permanent migration dealing with uncultivated and abandoned farmlands.

The ongoing establishment of 'food security' concept in Indonesia champions four conceptual frameworks in measuring the term 'security' (UNTIRTA 2017), which are 'availability', 'access', 'utilisation' and 'stabilisation'. Difficulties arise, however, when an attempt is made to put the frameworks into practice in Indonesia. The use of national policy to respond all regional issues may be linked to regulating policies in terms of strengthening institutional capacities in rural areas particularly that could support the wellbeing of farmers.

A study by The Indonesian Institute of Sciences (LIPI, 5 Oktober 2015) revealed four factors leading to continuing loss of farmers in Indonesia. Firstly, the decreasing numbers of farmers own their own lands, shifting farming from family-owned business to industry. The second factor is the aging problem of farmers. The study provides a census showing that most farmers nowadays are in the age of 45-50, meaning less on their productivity. Thirdly, the elder farmers could be in fact have only very basic education, elementary level at most, which then might find it hard to adapt agricultural technology. The next factor is farmers professional is not correlated with adequate income earning. Young villagers may seek other professions rather than following their parents to do farming jobs. This study aims to explore those interconnected factors and to test out as to whether the factors are in actual fact can be the basis of the argument of 'de-generation' of farmers.

Based on statistics published by BPS (2012) approximately up to 2009, 57 percent of Indonesians live in 79,075 villages and were relied on the villages for their living earnings (General Guidelines on Governing Villages 2014, p. iii). The data reported here appear to support the assumption that the existence of villages has had a significant contribution for the country and to confirm Indonesia's identity as agraris country. Thus it is believed that a proper joint-up strategies that could network national development policies, agricultural-plantation sectors and livestock sectors would likely lead to the prosperity of the rural community.

RESEARCH METHODS

The research approach is qualitative explorative. Critical ethnographic (Thomas cited in Creswell, 2012, p. 467) case study was taken to describe and to interpret socio-cultural system shaping the degeneration of famers issue. The idea is to drawing out themes from socially excluded communities in particular context. Jackson (cited Riswanda 2015 dan Riswanda et.al, 2016) revealed that discussing the 'voice' epistemology in qualitative research is really about how 'voices' should talk for themselves or in other words 'let voices speak for themselves'. This study investigates certain facts in which 'voice' should have been given to those excluded in the decision making cycles on a policy where they are at the reciving ends in fact — 'to give voice for the voiceless'.

The study is on critical systemic thinking tradition that goes with a mixed combination of methods. Combining critical ethnography (Carspecken, 1996 dan Denzin, 2001) and case study (Yin, 1994; Sjoberg et.al, 1991; Stake, 1995) aims to brige the voicing (by way of narrative interview), in which researchers are using multi-lenses by considering different views in differing contextual situation. Multi-stage purposive technique applied to discover and to sample the people in a network, where 'each person or unit is connected with another through a direct or indirect linkage' (Newman 2004, cited in Riswanda 2015, p.57). Sampling 'begins with one or a few people or cases and spreads out on the basis of links to the initial cases' in anticipation that 'no new names are given, indicating a closed network, or because the network is so large that it is at the limit of what [the researcher] can study' (Neuman 2004, p. 140).

RESULTS AND DISCUSSION

Description of the issue of de-generation of farmers is related with and influenced by multi-layers aspects and those can said systemic in essence. As another instance, the growing expansions of major capital funded industrialization bring in economic benefits for the locals but on the other hand, the expansions are taking over works normally done by local small trades such as transporting natural resources. The industries attracts the locals to leave their farming jobs to works as industrial providers, though in turn the industries provide their own resources needs, learned from the local trades. Consequently, farmers or family who left their farms to do industrial works are no longer benefited from the expansions whilst already lost track to go back farming. The critical ethnographic research thereby is vital to explore underlying aspects beneath the surface. The researchers blend in with local varied

stakeholders to find out. The paradigm of the research is following critical systemic thinking tradition (McIntyre-Mills 2006, 2010) and critical ethnographic policy research (Riswanda 2015, Riswanda et.al 2016a,b) in the effort to get insights from lived experienced of people. The research is qualitative in its approach and is likely to be a detailed case study. Thus the results will be discussed in narrative of stakeholders from various backgrounds both government and non-government sectors.

On the other hand, the tendency to works in factories nowadays seems to become an option considering farming lands have been owned by investors from mostly Jakarta. Locals are not involved in the investment and in most cases become laborers of the land they used to own. Local farmers' view are from agro-business industries. Instead of starting to expand their farm product to supermarkets, for instance, the local farmers stick with their traditional points of views, which are just making sure their granary filled with rice for their own consumption. This actual fact contradicts the growing industrialization in the area. The local government thinks supporting programs are adequate already in helping out farmers to escape the crisis of 'de-generation'. One of the long term program is called "Asuransi Usaha Tani" (Farming Production Insurance) to insure relatively massive harvest failure caused by wide spread pest (hama wereng) which is hard to cope with these days with respect to reason such as. However, such programs are not supported by farmers according to the local government. Pests' pendemics of "hama wereng" appears to have been pesticide immune since the improper use of the chemical. The widespread of the pests are now worsen by the exploitative used of paddy field by farmers without proper seasonal management, lack of climate change education from the local government together with lack of serious policy solution to deal with the systemic issue.

Farmers professionals today have been left out of discussion. But, it is not yet clear the factors beneath the surface, as to mean underlying factors behind the de-generation of farmers in Indonesia. The preliminary direct observation of this research comes up with several factors as to why farmers live their profession. Firstly, farming is viewed by some in place of profession which cannot fulfill live necessities. Climate changes, secondly, are also claimed to influence farming activities in relation to harvest failure made worse the view that farmers are not very prospective profession. Thirdly, whilst the country is known as agraris country, farming without owning lands or merely just sharecroppers. It comes by no surprise, thereby, farmers' welfare remains low shown by the higher percentage of poverty in rural areas than in more urban areas :

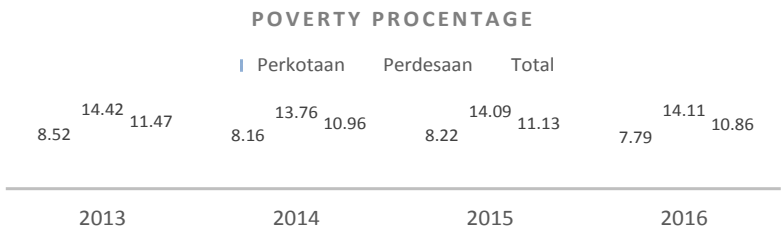

Figure 1. Comparation of Rural and Urban Poverty Procentage
(Source: Ministry of Trade of the Republic of Indonesia, 2016)

Poverty in many cases may be associated with the land conversion issues in many rural areas by which agricultural lands have been shifted in functions in their commercial usage as housing complex, industrial areas, business and trade centers. Agricultural lands have been decreasing annually converted into non-agricultural purpose or function. According to Directorate General of Infrastructure (cited in Warta Ekonomi 2014) 110,000 hectares of agricultural lands in Indonesia turned

out into other commercial used, whilst the land substitution programs are only 20,000-40,000 hectare per annum.

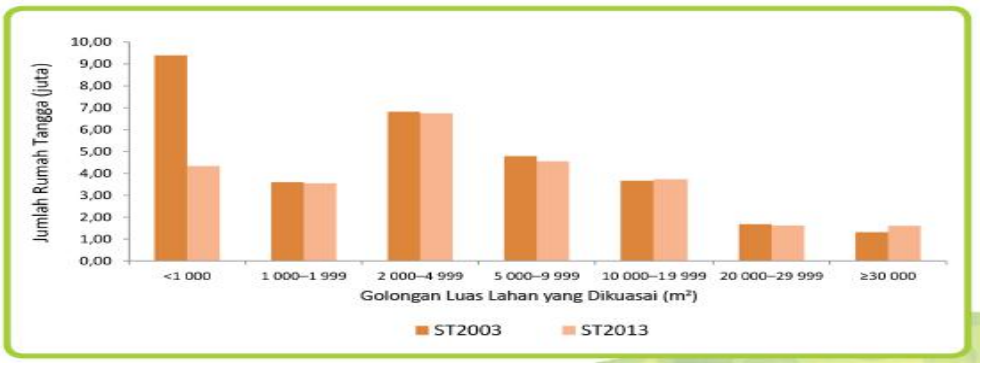

Figure 2. Occupied land ownership by farmers
(Source: Ministry of Trade of the Republic of Indonesia, 2016)

Indonesia has ratified the law no. 41 year 2009 about Sustainable Food Agricultural Lands making it compulsory for all regional governments to protect land ownerships from commercial used other than agricultural food productions. Nevertheless, no specific details regarding which land areas are to protect in its implementatation stage. Even so, the protection law is not yet properly adapted in regional policies with respect to land ownerships and their commercial non-agricultural use. For the Banten Province particularly the decresing numbers of agricultural land areas are continued :

Tabel 1. Wetland areas (by hectare) in Banten Province 2009-2014Provinsi Banten 2009-2014

No	Type of Lands	Tahun					
		2009	2010	2011	2012	2013	2014
1	Rice field with irrigation system	111,084	108,884	107,750	156,930	104,385	107,809
2	Non-irrigation rice field	84,725	87,860	89,415	34,090	90,331	93,265
3	Garden	170,267	167,393	167,297	165,759	165,559	171,801
4	Farm/ cultivated land	85,878	82,708	78,401	80,426	83,708	80,193
5	Lahan yang sementara tidak diusahakan	19,644	25,337	15,195	14,374	14,035	9,309

(Sumber: Bureau of Statistic Banten Province 2016)

The above table presents a significant decrease of land areas used for rice field with irrigation system on around 31.30 percent. This land convertion, especially the ones with irrigation system, could harm food self-sufficiency at national level and at the provincial level (Banten) which in turn could be a threat on food security. In Banten Province above all the convertion trend reaches 237 hectare annually (Food Security council of Banten Province 2016). Accordingly, declining numbers of household farmers in Banten seems to have been noteworthy.

The numbers of farmers in Banten is decreasing significantly. This is also shown by the declining numbers of farmers households in the Province by 33.59 percent (from 892 thousands in 2003 to 592 thousands by 2013). The highlighted point is on Tangerang District, as an instance, 222

thousands household famers change their profession and thuse contribute to the continuing decline into 86 thousands of farmers households.

Tabel 2. Numbers of farming household in Banten

	Name of City/ Regency	Numbers of farming households	
		2013	2003
01	Pandeglang	151	188
02	Lebak	187	203
03	Tangerang	86	222
04	Serang	127	190
71	Kota Tangerang	8	19
72	Kota Cilegon	8	16
73	Kota Serang	20	30
74	Kota Tangerang Selatan	5	21
	Banten Province	**592**	**892**

Sumber: Agriculture Cencus 2013 – Indonesian Bureau of Statistics

Tabel 3. Banten citizen aged older than 15 years old working as farmers

Age	2011	2012	2013	2014
15-19	27886	24122	15856	12701
20-24	40300	28015	29152	23941
25-29	67228	53401	60861	45146
30-34	51971	76291	69820	63276
35-39	74235	70323	77468	65047
40-44	100027	79508	112917	84948
45-49	72042	76326	80870	69948
50-54	69965	78697	91768	92972
55+	126468	116176	156474	147019
Numbers	630122	602859	695186	604998

Sumber: Banten Provincial Bureau of Statistic, 2016

Interconnected Aspects to De-Generating Farmers

Lack of knowledge in modern farming techniques is an issue regardless another related fact people in their productive ages seems to have lost their interests in farmer professional. Again, promising and permanent incomes have attracted these people to let their parents (who are now mostly in their elderly) do farming jobs. Sharing system ("maro" in Bahasa) is an actual farming production method where people rice-farm in group to do a single land. The system fits the local culture with strong solidarity. The government missed out adapting the system to their strategic programs. Natural economic market runs the system and so benefiting farmers to the extent where they can do farming and other works at the same time, but also create another issue. Mining industries are developed in the local area among agro-business industries. Some farmers are doing double job, laboring and farming with which the former has a threat to de-generate farmers professionals

Most farmers have lack of environmental knowledge in understanding ecosystem of agricultural production including how to use their farming land productively, such as avoiding excessive use of a

single land without any breaking time and to free the land from pest naturally without too much relying on pesticide or other chemical substances. The local government admits the lack of knowledge is due very limited numbers of agricultural extension workers on behalf of the Departments of Agriculture in terms of educating environmental knowledge to the locals. A village is ought to be supervised by one worker. In point of fact, a worker can supervise or responsible to three or more village. The incapacity of the Department of Agriculture in educating farmers seems to worsen the crisis of de-generation. Some farmers can be in-debt for saving harvests by looking out loans to buy pesticide and fertilizer.

Following the former argument, the impact of developing tourism activities on local agriculture-industry is another reason why somewhat the crisis of de-generation is continuing. According to a socio-religious leader, since farming lands have been sold to investors, farmers today could be merely low-rate labours paid by the investors. The above facts can be seen by the below picture.

Figure 3. Crop Failure in Sawarna

Some investors look out for lands in Sawarna for the reason of mining purpose. Massive invasion of China's investments result in urban lifestyle and mindset worsen the crisis of de-generation of farmers.

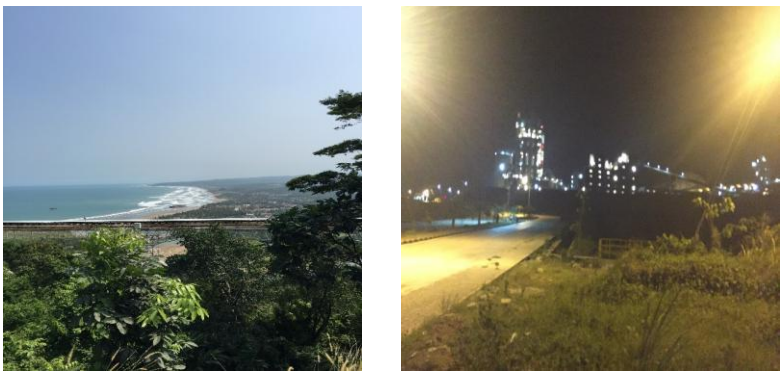

Figure 4. Industry Investment Around Sawarna

The photos show a massive land conversion coming with its all impacts to local farming and farmers from a foreign company

Meanwhile, a growing international company in the area, PT Semen Merah Putih, contributes to the lack of agricultural lands at Sawarna, although administratively the company just occupies 5 hectares of lands for the purpose of supplying raw materials in cement production. The threat is also coming from another investor who occupied some mountains that contains spring water to irrigate about 30 hectares of local rice fields.

Again, most local farmers view tourism industries as promising alternative incomes having seen to the massive paddy failure. The search for alternative incomes earnings such as motorcycle taxis driver, food stallers (kiosk), home stays and so forth going along with the development of tourist industries. The casual jobs drive nearly all local people to leave farmer professions. Economic survival influence not only the local farmers per se but also their families and relatives.

Serious attention from the Department of Agriculture, particularly in educating proper farming techniques. The attentions nevertheless should be in line with the socio-cultural understanding of the locals. Local farmers underline the way government doing the supervising program so far as disempowering farmers instead of blending in with the farmers either socio-culturally or economically. Accordingly, official economics supports could help with both farmers trapped in illegal rice dealers, making them fall in huge debt, and on top of all ruin the market price of locally produced rice and being too low. Loosing benefits from paddy fields is a main crisis of farmer' degeneration. Tourism industries now major attractions. As the two vies as a quick money related with surviving economic crisis caused by the systemic issues in local agriculture.

Limited financial supports are argued to be the main reason why barely no action taken from the local government to come up with policy actions controlling the invasion. No government control in determining market price on local agriculture products seemingly put farmer on the views that farming jobs are not worth doing economically compared with working in either tourism or industrial sectors. For example, a kilo of "singkong" (cassava) is worth only 1000 rupiahs (AUD 10 cents) on market. The cassava takes huge efforts to bring in from arable land. As a comparation, a person working as a motor vehicle taxi driver in the village can earn up to 1 million rupiah pe day (AUD 100) on the weekend.

Land Convertion

The tourism activity at Sawarna is developing fastly. Locals sell lands to companies as to work in the tourism sector. Seven companies have bought lands from the locals, some of them are PT. APS that have occupied wide heactares of land where which locals work as labourers, PT. Gama that works in mining and cemen industries. The threat though is the land convertion to be used for tourism sectors, taking over rice field and continuing to build homestays:

Figure 5. Rice fields at Cikawung Block turning into Homestays

CONCLUSION

Agriculture at Sawarna Village is degenerating to a large extent. This is due to the fact that agricultural sector cannot provide welfare supports of the farmers or those laboring at the sector. The ongoing development of tourism industries somewhat provides opportunities for the local community to have alternative income earnings and to have unconventional quality welfare supports.

Nonetheless, the alternatives might leave agricultural sectors unattractive and even left behind. The study has indicated four aspects shaping the degeration: The first factor could be economic in nature, arguing that agricultural sector cannot provide welfare supports in terms of providing adequate income earnings to those involved in the sector. Lack of atentions and supportive regulations on agicultural sectors from either the provincial or local government has been another leading factor which makes the efforts to occupy modern agricultural methods slow. The third factor seems to have been related closely with the ongoing establishment of tourism businesses in the Village. Land conversions seemingly come along with workforce or labour conversion. Lastly is to do with declining interest of the young generation in the village to become farmers. Better educational facilities has driven better educational attainment of most young people at the village than it was before. This last factor contribute to the less interest of the young to go on with agricultural sectors as their parents might have done.

Four reccomendations can be drawn out in accordance with the findings of the research. Agricultural business sectors needs improvement in terms of giving welfare scheme that could support local farmers' welfare. For instance, the scheme could be done by involving Indonesian Bureau of Statistic to deal with fixing the market price of rice. At the moment, the fixed price set up by the Bureau is too low and thereon makes farmers sell rice to 'tengkulak' (wholesaler or middlemen in English) making the selling unprofitable for the famers. The next strategies could be enforcing proper policies on Protecting Sustainable Agricultural Lands in Sawarna. The strategies would partner up agro-tourism programs in order to accommodate both agricultural sectors and tourism sectors in benefiting each other.

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ADOPTION OF INNOVATION TECHNOLOGY FROM THE ASPECT OF SOCIAL ECONOMIC CHARACTERS AND SOURCES OF INFORMATION

[1*)] Euis Dasipah, [1)] Karyana Kadma Sutara, [1)] Neni Amaliyyah

[1)] Universitas Winaya Mukti, Indonesia

[*)] Correspondence e-mail : euis_dasipah@yahoo.co.id

Abstract

The study was conducted in the sub-district Pacet Cianjur and used survey method. Research was carried out during the three months from April to June 2017. Based on the results of tests using the analysis of Structural Equation Modeling (SEM) then (1)The adoption of technology innovations farmers influenced by indicator: various of vegetables, changes of product, the treatment of post-harvest, marketing, the use of technology and the use of new things. The biggest contribution is in the treatment of post-harvest and changes in the product, (2)Characteristics of farmers (age, experience, formal education, and wide land) have positive relations with the source of information (companies of input, institutions of research and universities, buyer, extention agent (PPL) and the government, and the internet. Characteristics farmers have positive relations with the source of information (3)characteristics of farmers have positively influence on the adoption of technological innovation, among the indicator, shown the influence are experience and formal education. (4)The source of information have positively influence on the adoption of technology innovation.

Keywords : Innovation Technology, farmers Characteristics, Social Economic Character, Source of Information

INTRODUCTION

The general objective of our agricultural policy is to promote agriculture, to make agriculture more productive, production and production efficiency increasing and consequently the livelihood and welfare of farmers. In essence, government policy has three main objectives of efficiency, equity, and security / stability.

One of the horticultural commodities that has great potential to be developed is vegetables. The potential of Horticultural Development in Indonesia has considerable potential as it is supported by: legal / regulatory umbrella, biodiversity, availability of agricultural land, agro-climates (appropriate climate), technological support, labor availability, market availability, horticultural priority commodity support support Development of horticultural seed system and support for the development of horticultural protection system.

Research Background

Innovations in horticultural agriculture include innovations in cultivation technology, product quality, and post-harvest that is influenced by changes in community demand for horticultural products. Innovations include cultivation technologies such as superior seeds, environmentally friendly inputs such as organic fertilizers and environmentally friendly pesticides, planting media, and green houses.

Thinking about innovation is a new thing that can provide economic benefits or can be commercialized. Any new things like technology, new products, or new systems have not been called an innovation if they have not been able to provide economic benefits. Basically, the process of adoption through the stages before the community will accept / apply with their own beliefs, although the time interval between stages with each other is not always the same (depending on the nature of innovation, target characteristics, environmental conditions (physical and social), and activity / activities performed by extension workers).

Farmers have diverse characteristics, these characteristics can be demographic character, social and economic character. These characteristics distinguish the type of peasant behavior in certain situations. Social characteristics such as age, education, experience and land area. One of the elements that determine the success of vegetable farming is the fulfillment of farmers' need for agricultural information. The need for agricultural information must be met by available sources of information. Whether through formal or non formal sources of information. Differences in communication behavior of vegetable farmers related to the characteristics of vegetable farmers.

Acceptance of an innovation in reality is not as fast for every farmer, there are farmers who are quick to accept and some are slow. To adopt an innovation requires a certain period of time, this is influenced by the nature of innovation, socio-economic conditions of farmers, information sources, types of innovation decisions, social systems, reformer agency efforts and also the ability of farmers themselves (characteristics of farmers). Farmers have diverse socioeconomic conditions in their neighborhoods, so the level of application also varies.

Adoption of Innovation is the answer to the problems of vegetable farmers in Kecamatan Pacet in the face of the competition. The Kecamatan Pacet farmers have the opportunity to solve the problem through innovation. These opportunities include fairly accessible vegetable farming information innovations, fairly transparent market information, accessible capital access, and adequate infrastructure. So far only a few farmers are able to take advantage of these opportunities. The level of innovation is identified through several innovations made by farmers. These include the range of commodities cultivated, product changes, postharvest treatments, marketing activities, technology use, and the introduction of new things.

Research Objectives

Based on these problems, the objectives of the research are to analyze (1) The level of adoption of technological innovation of vegetable farmers and what indicators show the highest influence. (2) The relationship between characteristics of vegetable farmers (age, farming experience, formal education, and land area) with information sources (input companies, research institutes and universities, buyers, PPL and government, and the internet). (3) The influence of the characteristics of vegetable farmers on the adoption of technological innovation and what indicators show the highest impact. (4) The influence of information resources on the adoption of technological innovation and what indicators show the highest impact

RESEARCH METHOD

The method used is survey method. Selection of this location is done purposively with the consideration that District Pacet Cianjur regency is one of horticulture centers, especially the largest vegetables in West Java. In addition, Kecamatan Pacet has access to innovative vegetable farming through its innovative sources. The research unit (subject) is vegetable farmers who adopt technological innovation. While the object or research variables are: Adoption of Technology Innovation, Farmer's Characteristic, and Source of Innovation.

The research was conducted for three months, from April s.d. June 2017. The data tab uses the Microsoft Excel tool. Quantitative analysis in this study using SPSS for validity and reliability. To test the hypothesis used SEM analysis method (Structural Equation Modeling).

Sampling Respondent Method

Determining the size of the sample farmers using sampling method from Slovin with the formula:

$$n = \frac{N}{1 + Ne^2}$$

Descriptions :

n = Number of samples

N = Total population

E = error tolerance 5%
It will be concluded :

$$n = \frac{190}{1 + 190(0,05)^2} = 128,82$$

approximately 130 respondents. The allocation of sample sizes mentioned above in each village was using a proportional allocation of the formula:

$$n_1 = \frac{N_1}{N} n$$

description :
n_1 = Number of sample farmers from group i;;
n = sample size (overall) ;
N_i = Number of vegetable farmers in selected villages;
N = Total population of vegetable farmers in Kecamatan Pacet (region)

Hypothesis testing Structural Model

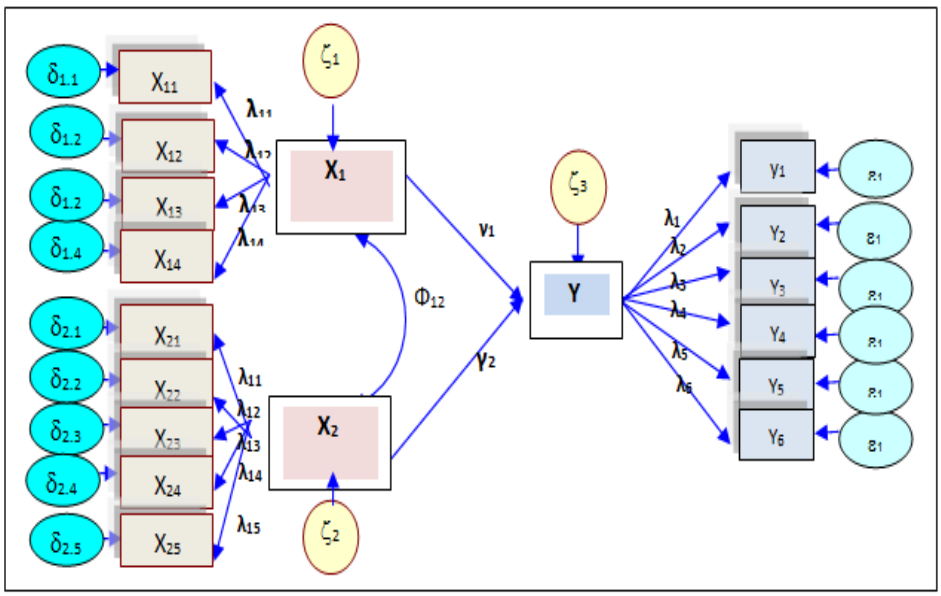

Figure 1: SEM Research Framework

Φ_{12} = correlation coefficient between Vegetable Farmer Characteristics with Source of Information (phi)
γ_1 = coefficient of influence Direct Characteristics of Vegetable Farmers on Technology Adoption [gamma1]
γ_2 = coefficient of influence Direct Source of Information on Technology Innovation Adoption [gamma2]
ζ = *error / error of each latent variable*

RESULTS AND DISCUSSION

Influence of Indicator to Variable Research

Table 1. Indicators Affecting Farmers' Characteristics

Var. Laten Eksogen	Indikator	Simbol	Estimate	t hitung	R^2	Error Varian
Farmer Characteristics (X_1)	Usia	X_{11}	0,76	12,19	0,73	0,21
	Pengalaman Berusahatani	X_{12}	1,00	15,88	0,99	0,00
	Pendidikan formal	X_{13}	0,87	13,53	0,83	0,15
	Luas lahan	X_{14}	0,78	12,91	0,79	0,16

The value of parameter estimation, stated significant in giving contribution or influence variable of Farmer's Characteristic directly.

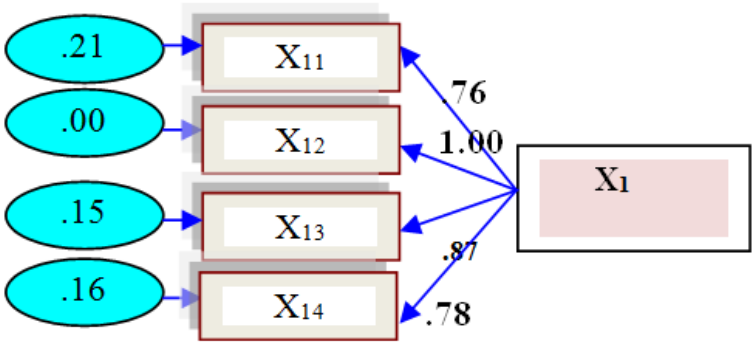

Figure 2. Construction indicator Exogenous latent variable Farmer Characteristics (X1)

All indicators expressed significantly in explaining the Exogenous Latent Variable Farmer Characteristics, absolute value of ttable greater than 1.96. Of the four indicators that are best in describing exogenous latent vaiabel Farmer Characteristics is an indicator of Farming Experience as having the greatest R2 value of 0.99 or 99 percent. The lowest indicator is the age indicator with R2 value of 0.73 or 73 percent.

Table 2. Indicators Affecting Information Resources

Var. Laten Eksogen	Indicator	Symbol	Estimates	t hitung	R^2	Error Varian
Information Sources (X_2)	Input Supplier Company	X_{21}	0.91	15.36	0.97	0.02
	Research Institution/ College	X_{22}	0.68	9.25	0.51	0.46
	Buyer	X_{23}	0.86	13.46	0.84	0.14
	Government	X_{24}	0.72	11.32	0.67	0.25
	Internet	X_{25}	0.064	1.41	0.016	0.25

The estimated value of the parameters, tcount, R^2 and variance error of the latent exogenous latent variable formator Source of Information (X_2) is stated significant in contributing or influencing the information source variable directly. The construction of the indicator on the exogenous latent variable Source of Information (X_2) is presented in Figure 3. The result of t test on the coefficient of parameter estimation, the four indicators are stated significant in explaining the Exogenous Latent Variable

Source of Information, the absolute value of the ttabel greater than 1.96. Of the four indicators that best describe exogenous latent variables Source of Information is indicator Provider Input because it has the largest R^2 value of 0.97 or 97 percent. The lowest indicator is the indicator of Research Institute / Higher Education with R^2 value of 0,51 or 51 percent.

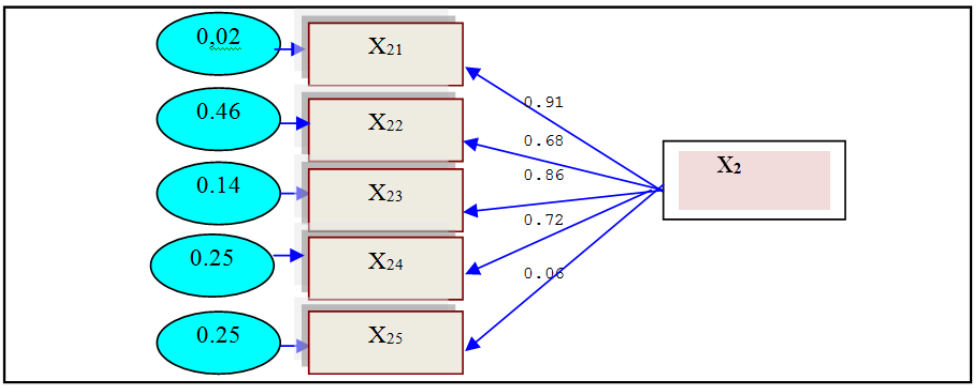

Figure 3. Construction of Exogenous Latent Variable X2 Source of Information

Table 3. Indicators Affecting Technology Innovation Adoption

	Var. Laten Endogen	Symbol	Estimates	t count	R^2	Error Varian
Adoption of Technology Innovation (Y)	Vegetable varian	Y_1	0.54	16.04	0.69	0.13
	Product Changing	Y_2	0.67	16.28	0.97	0.01
	Post Harvest Treatment	Y_3	0.69	16.64	1.00	0.01
	Marketing	Y_4	0.24	3.89	0.17	0.00
	Technology Usage	Y_5	0.55	11.97	0.69	0.28
	Use of New Things	Y_6	0.43	5.21	0.38	0.31

Indicates that the estimated value of the parameters, thitung, R^2 and variance error of the variable-forming indicator of Technology Innovation Adoption (Y) are significant in contributing or influencing the Adoption of Technology Innovation variables directly.

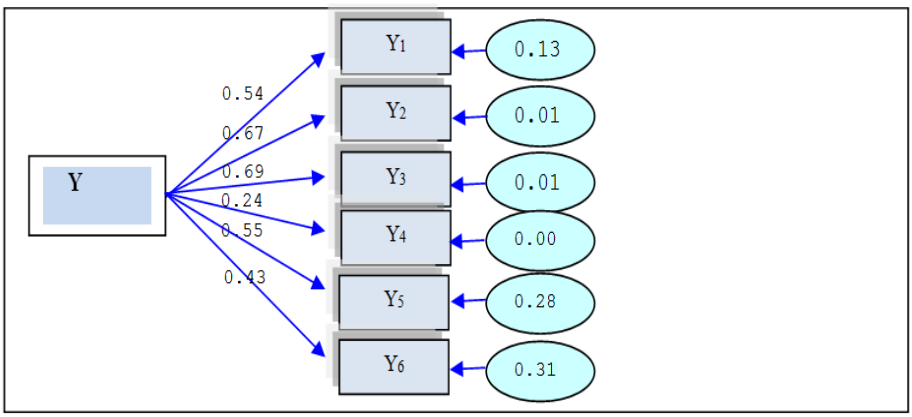

Figure 4: Endogenous Latent Variable Construction

Relationship of Farmers' Characteristics (X_1) With Source of Information (X_2)

Testing the relationship of Farmer's Characteristics (X_1) With Source of Information (X_2) by using Lisrel program statistic test,

Table 4. Calculation Result of Farmer Characteristic Relationship (X_1) With Source Information (X_2)

Variables	Farmer Characteristics	Information Source
Farmer Characteristics		0,33
Information Source	0,33	

Characteristics Farmers have a significant relationship with the Source of Information, the correlation value of 0.33 criteria of weak but real relationships because bigger than rtabel (r0,95%; 130 = 0.174). The level of relationship between the two variables can be said to improve access to the use of Source of Information influenced by the characteristics of farmers and also vice versa that the source of information provided to increase technology adoption then the source of information needs to adjust to the characteristics of farmers.

Partial Testing

To know the influence of each exogenous latent variable Farmer Characteristics (X1) and exogenous latent variable Source of Information Technology (X2) to endogenous latent variable Adoption of Technology Innovation (Y).

The result of statistical analysis of the effect of Farmers Characteristic (X1) and Source of Information (X2) to Technology Innovation Adoption (Y) is presented in the following table.

Table 5. Partial Influence Variable Farmers' Characteristics (X1) and Source of Information (X2) on Technology Innovation Adoption (Y)

Variables	Line Coefficient (Standardized)	Standard Error	value $t_{count.}$	Test Result (α=0,05)	R^2
Farmer Characteristics (X_1)	0.33	0.098	3,37	S	0,80
Information Source (X_2)	0.73	0.13	5,72	S	

When comparing the magnitude of the influence of both variables, the influence of the Source of Information (X2) variables shows a higher influence than the influence of farmer characteristic variable (X1). The direct effect of the information source (X2) variable is 53.29 percent obtained from the square of 0.73 and the direct influence of Farmer Characteristics of 10.89 percent obtained from the square of 0.33

The amount of Influence of Research Variables

Based on SEM analysis and path diagram, the influence of each variable is direct and indirect is as follows.

Table 6. Number of Direct and Indirect Influence of Vegetable Farmer's Variables Characteristic (X1) and Source of Information (X2) on Technology Innovation Adoption (Y).

Line	Direct Influence	Indirect Influence		Total
		X_1	X_2	
γ_1 = 0,33	10,89 %		7,87 %	18,77 %
γ_2 = 0,73	53,29 %	7,87 %		61,17 %
R^2	Influence X_1 and X_2			79,94 %
1-R^2	Influenced by Other Factors			20,06 %
Total	Total Influence			100,00 %

The results of this study indicate that the characteristics of vegetable farmers and information sources is an important factor in influencing farmers adopt technological innovation. Of the two variables, the highest contribution is from the variable of the information source. It is important to always improve and provide farmers with information sources to better adopt technological innovation.

Discussion

Effect of Vegetable Farmer's Characteristic on Technology Adoption

Each respondent farmer in this study has different economic and social backgrounds. Characteristics that distinguish between respondents include age, education level, experience farming vegetables, and the area of land owned. The similarity of each respondent is a farmer with equal access to the source of innovation. On this basis, the respondents selected are group leaders or other farmers who are close to the source of innovation.

As stated Soekartawi (2005) that the characteristics of individuals or groups is one that must be considered in the process of adoption of innovation. This is useful in planning the application of innovation to be determined.

The effect of age against technology adoption

Age is one characteristic of individuals who have a relationship with the level of innovation. But in agribusiness activities, farmers and business people who have a young age is more innovative than older farmers. Young farmers have so far shown an openness in accepting new things including innovation. Young farmers have a passion for knowing what is not known, so that they are trying to make innovation adopt more quickly even though they are not experienced in the innovation.

The influence of the entrepreneurship experience on technology innovation adoption

The influence of the experience of engaging in innovation adoption rates is positive or of one-sided value. A unidirectional correlation indicates that longer farming experiences are associated with high adoption rates of innovation.

The results of the analysis show that there is a direct relationship between increasing the experience of farming with innovation decision making.

The influence of formal education on innovation adoption

The level of formal education is one of the important studies in identifying the level of innovation made by farmers. Referring to the opinion of Ujang (2004) which states that one's education level will affect the values held, the way of thinking, the perspective, and opinion of a problem, then it happens to the business and innovation issues that must be taken.

Respondents of this study have a level of education spread from junior high school education to those who have studied strata 1 (S1), but more spread in higher education level and S1. This research refers to Novarianto (1990), Mugniesyah and Lubis (1990), Nofa (2010), and Kartiwa (2010) stating that the higher level of education of farmers will be the higher level of innovation adoption in carrying out their farming activities. The value of the regression coefficient between the level of formal education with the adoption of technological innovation of vegetable farmer Kecamatan Pacet showed a positive result. The relationship of education level to the adoption of innovation was insignificant. This shows that in this study concluded that there is no significant relationship between education level and adoption of innovation. There is no real correlation between educational level and innovation adoption because every farmer of all levels of education in Pacet has the same tendency to adopt an innovation.

Influence of land area to innovation adoption

Referring to Nofa (2010) and Irvani (2011) who convey that the more land that is controlled by farmers will be directly proportional to the level of innovation made by farmers. This is related to the choice of farmers who are more flexible in adopting innovation if they have a wider land area.

The results of this study proves that the level of achievement of farmer characteristics shows that farmers have enough land area (0.4 - 0.74 ha) better in the adoption of technological innovation. Similar interest in adoption is influenced by farmers' awareness of agricultural conditions where land

quality decreases and increases in plant diseases. So farmers in general believe only with innovation improvements will be achieved.

The Influence of Information Resources on Technology Adoption

Influence input company

Sources of information from input companies have a significant effect on the adoption of technological innovation. The magnitude of influence The source of information from input companies showed positive signs in the meaning of input companies positively affect the meaning the more information obtained by farmers the better the level of technology adoption.

Production input companies are more operational institutions and know and follow what the farmers need. The interaction between them is very intensive, especially the company that is ridden by business interests. The company's attention seems bigger to the farmers and they become partners in the information technology. Periodically, companies conduct meetings with incentives that appeal to farmers. In addition, the company tries to convince farmers to introduce technology through various demonstrations in the field (demonstration plots).

Influence of information sources of research institutions and universities

Sources of information technology from research institutions or universities have no significant effect on the adoption of technological innovation. The magnitude of the influence of information technology resources from research institutions or colleges of influence that is very small or even almost no effect. Nevertheless, from information and information from respondents, the information source from the research institute or university is often the technology package that is delivered is not touching what the farmers need, and it is not operational yet.

Buyer's influence.

Buyers in this regard provide a source of information technology actually provide adoption of technology for vegetable farmers in Kecamatan Pacet, but no real effect. People / buyers start to use innovation if the profits are higher. So the drive to learn innovation is getting higher.

The effect of PPL and government information resources

Sources of information from PPL or government have no significant effect on technology adoption. The existence of PPL and Government in terms of providing information technology resources has actually been running regularly and programmed. In fact there have been scheduled officers who provide counseling (PPL). However, from the information and information of respondents, the information sources from PPL and the Government are often the technology packages given in the extension do not touch what the farmers need, and often technology. Keep in mind that production technology at farms requires advanced technology and follows market trends. The speed of changing changes in the field seems less anticipated by the government.

Another problem of PPL and government information sources is that the technical side of scheduled deliver- ment is often less synchronized with farmers' opportunities in providing their spare time. Vegetable farmers who are very busy carry out their farm activities require that information is needed whenever and wherever. Therefore watu counseling scheduled let alone rigid often not effective.

Internet influence

Sources of information from the internet significantly affect the adoption of technology. The amount of influence Source of information from the internet shown by the number of positive regression coefficient, meaning more information obtained by farmers from the internet then the better the level of technology adoption.

Information on production technology for vegetable farming that develops in communities around farmers and including fellow farmers in the study site is very much. Farmers are very easy to access and free of charge. In addition, the information is also supported by the fact that occurred in the field. Farmers are not hesitant to participate in implementing the technology.

CONCLUSION

1. The adoption of technological innovation of vegetable farmers is influenced by indicators: variety of vegetables, product changes, post-harvest treatment, marketing, technology use, and the use of new things. Among the six indicators of technological innovation adoption variables that provide the greatest contribution are in post-harvest treatment and product changes
2. Characteristics of farmers have a positive relationship with Source of information.
3. Characteristics of vegetable farmers positively affect the adoption of technological innovation, Indicator which shows the highest influence is the experience of farming and formal education of farmers.
4. Sources of information positively influence the adoption of technological innovation. The highest indicator of influence is the input and buyer companies.

Suggestion

1. Package of technology submitted by the source of information is expected in accordance with the needs of farmers, is operational delivered more communicative and adapted to local content.
2. Selecting the right agricultural innovation (good innovation) so that farmers are interested in using the product. Characteristics of vegetable farmers should be a major concentration in the application of technological innovation
3. Choosing an effective extension method the strategy of selecting appropriate extension methods should take into account two issues, namely the content of the message to be delivered and the targeted target
4. Empower the optimal extension agent (good extension agent) select extension officers and empower the role of extension officers as optimally as possible.

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CONTRIBUTION OF CITIZENS LEARN IN THE FINANCE LEARNING COMMUNITIES ACTIVITIES TO SUPPORT THE SECURITY OF FOOD IN BANTEN PROVINCE YEAR 2017

Sudadio

University of Sultan Ageng Tirtayasa

Correspondence e-mail : dr.dio@untirta.ac.id

Abstract

Education is the rights and obligations for all citizens, said rights as every citizen is entitled to a decent education in the framework of the development potential of himself, while the obligation is said to be where the community obliged to participate actively in supporting this process of quality education. From the results of research and discussion aimed at answering the focus of the research issues it can be stated that: " *Contribution of Citizens Learn in the Finance Learning Communities Activities to Support the Security of Food in Banten Provnce, is :* 1) Contributions of elementary school, 73.30 percent (140,500), 2) Contributions of the first secondary schools equality 72.77 percent (201,000), 3) Contributions of hight school equity 55.54 (295,000), this means a larger community in the finance community learning rather than the Government., It is high time that Government should be able to finance the activities of community learning in primary and secondary education minimum average 232,875 intermediate/per citizens learn/month. Implications of the through community learning activities will result in the Community competencies, are with competence gained from the activities of the community learning, community will ultimately has the level of empowermwnt and productivity a reliable that finally the community independently can guarantee himself even others in the food security of the continuous and ongoing.

Keywords: community learning support food security

INTRODUCTION

As set forth in the national education system Act No. 20 year 2003 article 13 paragraph 1, that the national education consists of three lines that is the path of formal education, informal, and Nonfirmal which is inseparable from one another mutually bethubungan seta, special study authors will focus on studies on the scope of the non-formal education, as the education touched nonfoirmallah occurrence of activities learning communities with different types of program life skillnya This Article the outhors focus on the study of nonformal education, because this is on the most appropriate and relevant a container holding of learning community. To support this learning activity learning communityo power is need for support of a variety of decent resources as container activities for this the following visualization learning community program agencies is; trainings Life skill, youth skills, training Skill women, Literacy, Equality education, Early childhood education, trainings of beutiful.

Focus of the review was directed at the institution that hosts learning community activities, such as the central activity of learning community and activities, notably workshops in pkbm is a container of learning society in order to acquire knowledge and skill through a programe such as equality, literacy, skills, courses are held according to needs of the citizens are learning that they might in the future be empowered in order to.

Trough pusat kegiatan belajar masyarakat expected : 1) accur as required learning activities, 2) accurrence of sustainabuility programe are good and can spur outonomi, productivities, and empowerment, 3) can independence, so that the community can contribute to the development of the nation.

Activities in accordance with the principle of community that is of the people, this is also in line with the principle of the framework for qualification of the Bedouin Al Indonesia (KKNI) which all forms of activity the learning community will be calculated so that itcan be synchronized with a qualifying grade raging from the highest , so there is no possibility of activities get the opportunity to learning community synchronesed with formal education graduates as equivalent to elementary school, junior high school, doctoral graduates even though.

On this basis, the author is interestedin reviewing "Contribution of Citizens Learn in the Finance Learning Communities Activities to Support the Security of Food in Banten Provnce Year 2017"

Literatur Review

Education cost

Financing of education is a process of utilization of resourcess education effectively and efficiently in order to support the activities of the educational process in this deserve quality.

Consisting of namely; 1 unit of education investment costs) which includes the provision of the means, the development of HUMAN RESOURCES, working capital and fixed, 2) personal fee covers the cost of student activity units ormbelsharab, 3) unit operating costs include: a. correction education) teacher salaries and staff, b) the cost of purchasing and learning facilities, c) maintenance costs and procurement means.

In accordance with the laws of the national education system the number 20 in 2003; article, 46 States, a) the responsibility of the education funding. shared between Governments, to regional and community dribrah., b) Government, local government and the community are responsible for providing the education budget.

Poverty and ignorance

Problem fundamental in developing countries which were still high number of poverty and ignorance, so that this can be one of the causes of the prisoner's *food security (food insecurity)* in the country .

This happens also in Banten Province, according to data from the Office of education of Banten Province year 2015 there are still 51. 000 inhabitants more inhabitants Banten illiteracy it is already happening oenurunan, where in the year 2013 is still numbered 213, 804 inhabitants more yg illiterate (1.9 percent), the statistics agency Banten 2017.

This state grew, because still there are 2912 year 5.71 percent of the population of Banten yabg poor (642 539) Central Bureau of statistics of Banten 2012, where poverty is the highest found in Pandeglang 9.27 per cent (1. 043,242 inhabitants) and Regency of Lebak as much as the poor soul 969 999.

Poverty and ignorance is not a derivative is not also a curse, because of poverty and ignorance can be addressed and can be prevented by providing a variety of active education and training programs as well as learning a life skill and community such practical training, courses, literacy and equality that are relevant to the needs of the community with the goal of keeping the community the more helpless.

Reviewing the picture number two, it can be assumed that poverty and ignorance is the twin brother of the interconnected nature of the causal and means that it is one of the causes of the occurrence of ignorance as well as opposite. This will spinning and takes place continuously during not cut one of them.

Therefore, one of the strategic program is provide knowledge and skills for life skills to every population, through a variety of educational activities and community-based learning with the ownership appropriate skills expected of EACH inhabitant has a kemampunan for a more empowered and productive in order to live a life of safe food but not food insecurity .

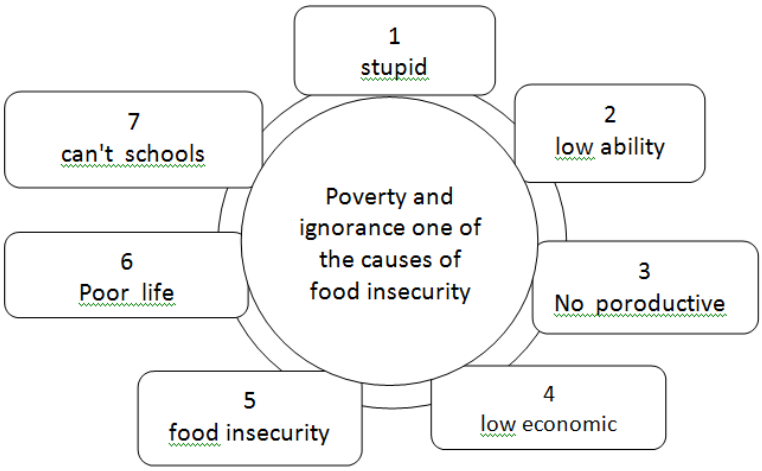

Figure 1. the Cirle of Devils Poverty and stupid

Empowerment

Empowerment is a dynamic and synergistic activity that encourages the involvement of all potential (Suhendra, 2006:74). (ttps://cocomkomar.wordpress.com/2013 / 9 september 2017 pm 9.00)

Empowerment is the utilization of the capacity of individuals, groups, or communities to take control of their circumstances, exercise power to achieve my own goals, with dynamic processes both individually and collectively in order to help himself and other double (https://en.wikipedia.org/wki/Empowermen, 9 September 17/ jam 8.45)

Observe both the concept of this empowerment, can be abstracted that empowerment is a process which is dynamic and sustainable and synergistic by utilizing all potential and capacity owned by individuals, groups or communities in order for u help himself or others in order to improve the quality of life.

Empowerment strategic

To be sure someone is defenseless to strategic action is required which can be made as provision for individual and Community competence, particularly in the area of economic insecurity, prone, prone-prone education the experience, ability, all the insecurity it can get on the program through the activities of the Community supply in order to provide the various life skill abilities, but otherwise follow the learning there are some things that need to be owned by the individual to be helpless such as. ; 1) have ability /punya kemampuan; 2) confident / percaya diri, 3) honest / jujur, 4) good moralty /moral baik, 5) networking /hubungan kerja, 6) willingness/ kemauan, 7) kesempatan/opportunity, 8) Kekuasaan /power, 9) Bertanggung jawab /accountability

RESEARCH METHODS

This research study is focused to get data about the contribution of citizens to participate in learning activities learning finance this society we use qualitative descriptive, whereas to obtain research data acts as a human instrument while to get valid data pins using observation and interview guidelines as well as the study of documents, While Qualitative data collection procedures include: 1) orientation stage: at this stage researchers conducted preliminary studies, this is intended to obtain the completeness of field conditions, sources data and data that will be required, 2) exploration stage: at this stage researchers do real research ie data collection using the guidelines for obeservation, interview guidelines, and document assessment guidelines, 3) stage of memberchek and triangulation:

at this stage researchers do re-check data obtained by way of re-requesting the data source (respondent) against the answers given in order to equate perception.

While to process and analyze data, researchers perform data analysis techniques that include; 1) the reduction stage, at this stage the researcher summarizes the summary of the respondents 'main points, to get the conformity of the respondents' answers with the research focus, 2) the display stage, at this stage the researcher performs the data presentation in order to know, check and formulate the data obtained in narrative aimed at answering the focus of research, 3), verification stage:at this stage researchers draw narrative narrative,this conclusion it is necessary to know that the data has answered the problem or research focus.

RESULT AND DISCUSSION

Based on the results of research aimed at answering the sub focus research issues i.e., Contribution of Citizens Learn in the Finance Learning Communities Activities to Support the Security of Food in Banten Provnce. It can be stated that citizens learn equality package à par primary school, equality package B the equivalent of junior high school and equality package C equivalent high school of data triangulation was done in advance and memberchek stated already participating with good data, Contribution of Citizens Learn in the Finance Learning Communities Activities to Support the Security of Food in Banten Province Year 2017. the following contribution can be seen as indicated in the following matrix

Table 1. Contribution of Citizens Learn in the Finance Learning Communities Activities to Support the Security of Food in Banten Provnce

Number	Type of Contribution	Magnitude of Donation		
		Package A	Package A B	Package A C
1	Donation	475.000	240.000	184.000
2	Cost go to school	15.000	7000	10.000
3	Expenses allowance	17.000	15.000	25.000
4	Uniform	370.000	100.000	130.000
5	Shoes	238.000	100.000	100.000
6	Buy books	398.000	139.000	210.000
7	Buy bags	368.000	144.000	175.000
8	Eating	110.000	28.000	30.000
	Average	**630.000**	**778.000**	**967.000**
	Ratio of the community with the government	140.500/BL : 37.500	201500/ BLN : 55.000	295.000/BLN 140.000
	Mean value	7.99	7.66	7,66

Based on an analysis of data provided in the matrix can be explained that community involvement in the Fund itself to follow in hopes of learning to be more empowered to follow with equality, literacy, learning skills for life skill courses and various forms of it can be stated that the quantity contribution of equality, 1) elementary school of 73.30 percent (140,500), 2) magnitude of the contributions of the first secondary schools equality 72.77 percent (201,000), 3) quantity high school equity contribution of 55.54 (295,000), this means a larger community in the finance community learning rather than the Government.

On the basis of this, it can be stated that to make the society his powerless to specific rural communities with low economic status, it takes the form of strategic programs join the equality, literacy, the skills course as for productive living and for empowerment,

CONCLUSION

Based on the results of the research and the discussion it can be concludent that *Contribution of Citizens Learn in the Finance Learning Communities Activities to Support the Security of Food in Banten Provnce*; is, 1) contributions of elementary school, 73.30 percent (140,500), 2) contributions of the first secondary schools equality 72.77 percent (201,000), 3) contribution of hight school equity 55.54 (295,000), this means a larger community in the finance community learning rather than the Government.

Look at this condition, if the Government wants the people to Sepik and productive, then it should be the Government can allocate the costs of education or exercise programs are equality of primary and secondary education and guaranteed quality is minimal availability costs 232,875/learners/month.

The implications of success learning community expected life of the community will be more empowered, with a helpless community expected expected to be productive, and ultimately food security community can be secured directly constant and continuous.

Following visualization of the learning process in order of occurrence of ecological community, as the following three images.

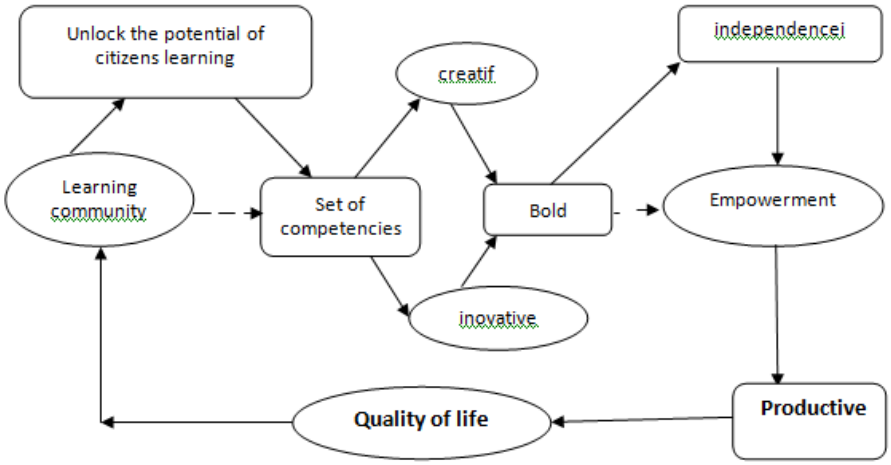

Figure 2. Learning Community Process for Empowerment

In order to achieve food security, required provision to the public in the form of life skills skill, this life skill competence can be obtained by way of communities following various activities and educational programs and proper practice as needed such as cultivation training, fisheries management exercises, beauty clearance, culinary training and others, by obtaining a set of life skill competencies in the end it is expected that the community can empower itself in order to improve the degree and quality of life and to achieve a decent and prosperous life.

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ROLE OF LOCAL GOVERNMENT IN FOOD AVAILABILITY BASED ON INDONESIA'S FOOD LAW IN SERANG CITY

[1] Ikomatussuniah, [1] Nurikah, [3*] Widiatul Arafah

[1] University of Sultan Ageng Tirtayasa, Indonesia

[*] Correspondence e-mail : widiatularafah@yahoo.co.id

Abstract

The authority in terms of food availability that has been mandated in Indonesia's food law said that the Central Government and Local Government are responsible for food availability. Units of Local Government are assigned by The Ministry Of the Agriculture Republic of Indonesia to do their obligation in the food security field. Role of Serang City Government effort is needed for increasing food security. With literature research and field studies, it can be seen on the reality that Serang City does not have a specific institution yet to solve food security problems. Subsequently, all of these problems make the obligation of Serang's Agricultural Institution full. In this case, a specific food institution whose tackling food problems is needed.

Keywords : food availability, food security, local government.

INTRODUCTION

Indonesia is known as an agricultural country, most of its inhabitants work in agriculture. This situation should be a favorable thing for Indonesia, because of with vast green lands and biodiversity, can make it as a prosperous country and make its citizens safe. Indonesia has a wide range of agricultural land, plantation, water areas, and representative forest. However, every year 100,000 hectares of agricultural land shrinks, plantation productivity declines, water areas decline due to the destruction of water areas and decreasing forest areas due to illegal logging and licensing systems both legal and illegal in Forest Management Rights that decline and disappear forests function. Logically, as an agrarian country, Indonesia can meet the food which needed to its people properly and sustainably (Ikomatussuniah, 2017). The problem of declining forest areas is not the only impediment of food fulfillment, but other problems can appear such as in population growth. This can be a serious threat for Indonesia, because of the increasing population will rise the need for food too, and it will occur other problems in the environment, social and economic sectors. The emergence of food problems related will occur to social problems that caused food scarcity if the economic sector distrupted. For instance, in real market the are high demands of staple food, incontrary the food avilability cannot meet it. This becomes a major problem that needs to be resolved by the government as agency that have to responsible in the prosperity of its citizens. Moreover, Indonesia is a welfare state that it has very wide obligation to organize the public interests. In addition, state has their own freedom in administration accordance with the authority given based on regulations. With such authority, the government has to responsible for the welfare of its citizens, especially to fulfill the right to food for citizen (Ikomatussuniah, 2013). In this condition, government needs to establish an food institution or food agency to tackle food security. This institution should be integrated both at the central and regional levels because of food security problem becomes a serious thing that must be invoked by the government central and regional.

Banten is one of Indonesian province that established on 4Th October 2000. it consists of 8 districts or cities, and one of its areas is Serang City. This city is capital city of Banten province than it should be a reference for other districts or cities in Banten province. The growth of Serang City population based on data from Central Bureau of Statistics (BPS), notes that the population growth

rate in Serang City each year is 0.77 percent (BPS, 2016). Subsequently, the government have to create covenant on food security policy because one of the government authorities in agriculture is encompass the standard norms of procurement, management, and distribution of food (Kansil, 2004). The availability of food is important in efforts to meet the food which needed to the people, especially the basic needs of the community along with the increasing population growth. A rise in global food prices could lead to improve a number of famine citizens. Lack of food and malnutrition in a country will create a generation that less intelligent, weak physically and less productive. So, it can be assume that Serang City needs their own food sovereignty. Food sovereignty is a way of achieving concept of walfare state in Indonesia based on Indonesian preambule constitution 1945 in fourth paragraph. In the same way food sovereignty has been enshrined in Indonesian food law. Indonesia, the country based on the law, emphasize based on food sovereignty rights, then the state have to guarantee the right to food for its inhibitants. In this condition people has the right to determine the food system in accordance with the potential of its local resources or local wisdom. Moreover, every countries must be able to protect, to provide and to fulfill food for it's people up to themselves (Ikomatussuniah, 2016). The availability of food is to meet people needed, and people's food becomes a matter that must be paid attention by the government in each region respectively. In addition, food availability and food security are parts of food sovereignty.

Food security is a duty of central government and each local government in their respective regions. As stated in Article 12 (1), 12 (2) of No. 18/2012 on Food Law (for next occur we assume it as 'FL') stated that the Government and local governments are responsible for the availability of food. And also determine that the Government and local governments are responsible for the availability of food in the region and the development of local food production. Local government, in this case, the Government of Serang City, has an obligation to prosper the community, especially for sufficient food supply in Serang City. Local governments need to pay attention to food planning regularly, distribution of food and marketing. As a general welfare organizer, the government's duties include all social fields, that are actively participating in government administration in public health, teaching, food and agrarian duties. Thus, state administrators have freedom of action, especially in the urgent circumstances that occur, while the settlement regulation has not established (Djamali, 2012). This also applies to local governments to assign a particular body or institution in the field of food to provoke the availability of food in the Serang City, because the authority of food security is the authority of its Local Government.

The duties of local government related to the availability of food in the effort to protect, to provide and to fulfill the right to food of the people has been regulated in Regulation the Minister of Agriculture Republic of Indonesia No. 43/Permentan/OT.010/8/2016 about Guidelines of Nomenclature, Duties, and Functions of Institution of Food and Local Agricultural Affairs at Province and District/City (for next we called it 'The Guidelines') that in the settlement of food resilience issues, resolved by the Regional Device Work Unit (SKPD) Which specialized in handling food affairs. In the case on jurisdiction local area, the body (SKPD) of food its called Local Institution of Food Security. Incontrary, if in jurisdiction of local area has not established bodies food based on The Guidelines mandated, can assume that the regional government is not implement the array. Moreover, based on the reality, Serang City is the only one City of Banten Province that has not have Food Security Institution compare other districts/cities. This ilustrate that Serang City Government does not see the problem of food security as a matter of specific concern, it can be seen that the Government of Serang City cannot implement the Guidelines if the institution of food has not created yet. The Guidelines essentially created to fulfill the right to food based on Indonesian Constitution. For Serang City, the formation of food security institution can be done by the Serang City's Government to protect, to provide and to fulfill the right to food of its inhibitants. The instituion could lead the local government to facilitate surveillance functions on the right to food. Subsequently, The Guidelines have to implement by all local governments including Serang City. Based on the glance exposure about local food institution, The Guidelines should be implement to all regions, but the Serang City has not established

the institution that mandated, then if this situation still occur, the problem is how Serang City could be handled the food problems to prosperous people's life.

RESEARCH METHOD

The method of research is empirical approach refers to food law and social condition that exists in society. This research is included in the type of descriptive analytical research because it describes the role in Serang City in protect, provide and fulfill the right to food. Secondary data is used, such as bibliographic data, journals, scientific papers, articles and documents related to the research material. In addition, researchers use primary data sources as a source, that is done by interview. In this research, the interview was conducted to Head of Food at Agriculture Institution of Serang City, Mrs. Andriyani, M.P. Data that have been collected from the results of research and then analyzed qualitatively.

RESULT AND DISCUSSION

Food Availability in Serang City

Food is a basic human need, and the state is obliged to realize the availability, reach, and fulfillment of adequate, safe, quality and balanced nutritious food consumption both nationally and regionally up to individuality in all regions of the Indonesian Republic as well as in Serang City. This can be realized by the Government of Serang City by utilizing local resources, in other hand local food institution must be strengthened. In addition, based on the population census conducted by the BPS in 2015, Serang City is a region with a fairly dense population, that cover 643,205 inhabitants, while the total area of Serang City is 266.71 km^2. One thing to point out is based on the number of people and its area, Government can improve the natural and food resources, then fulfill all communities needed in this situation for people up to themselves (Ikomatussuniah, 2014) This is also mentioned in article 1 of FL, that food is everything, role or processed, originated from biological sources as product of agriculture, plantations, forestry, fishery, animal farming, and water, which is used as food or drink for human consumption including its additives, raw materials, and other materials used in the preparation, processing, and/or manufacturing of food and drink. In this sense, the definition of food is very broad, so it needs government involve to meet the right to food.

Food availability in Article 1 (6) of Government Regulation No. 17/2015 about Food Security and Nutrition, said that the availability food condition are from domestic production and food national reserves then imports will be done to fulfill if both resources can not meet the needs. In order to meet the food supply, Serang City needs to pay attention to domestic production and national food reserves, then if the two food sources are not met, the efforts of Serang City to fulfill the food supply is by importing food or food procurement from other areas. The availability of food can affect the livelihood of the community, both producers (farmers) and consumers. So that the people of Serang City and the state organizers have the right to determine their food security system independently. Food security is basically rooted in the fulfillment of food for households, which is reflected in the availability of adequate food, both in quantity and quality, safe, equitable, and affordable, Whereas there are three subsystems in food security, there are availability, access, and food absorption. The three subsystems must be met and related to each other, so that if one of the subsystems are not met then the food security can be said still fragile. Two main subsystems that must be realized by the Serang City, in this case, is the availability of food and food access. For that, it needs to be thought that food security is more a massive system of two main interrelated subsystems, which are producers and production, and consumers and their consumption. Each food security subsystems are determined by the components that support each other, including the community and the organizer of food security itself (Sunarmito, 2014)

The local government is responsible for the availability of adequate food for the community, because the local government is committed to improving the welfare of the community, and it can start from improving the management of agricultural land. So, that crops can increase, not only rice crops but also other crops such as corn and soybean. This is also an effort that needs to be done by the Serang City in realizing the availability of food. Therefore, what can be done by the local government is through food self-sufficiency program. This program must be considered by the local government, in addition to Human Development Index (HDI), eventhough many industries entering into an area, agricultural lands have to keep up (Salim, 2016) Subsequently, when the population growth experiences sky rocketing, the population need a lot of food, in this situation government should do their obligation to protect, to provide and to fulfill people's right to food. These obligation by atribution appears on Article 12 (2) of FL, stated that central government and local government are responsible for the availability of food. Futhermore, based on article 3 (d) of Serang City Regulation Number 7/2016 about the Establishment and Structuring of Serang City Regional Device, mentioning that the Agriculture Office organizes government affairs in agriculture, marine and fishery, and food field the authority is owned by Agriculture Institution of Serang City. To implement food availability the local government can cooperate among other Institution. However, the major tasked of its function is still in Serang City's Agricultural Institution authority. The atribution of Serang City's Agricultural Institution to handle food problems caused the main duties and function of Serang City's Agricultural Institution consentrated. Thus, the problem of food security are not only on agricultural sector itself, but social and economic sectors are included. The complexity of food security problem is one of the problem and on the other hand agricultural problem assumed as a massive problem. So, all of that caused a dense task of Agriculture Berau of Serang City to emphasize food security.

Based on article 12 of FL said that in to create food availability, Serang City as a local government should develop domestic production of food with some measures :

a. Developing food production that relies on resources, institutions, and local wisdom.
b. Developing the efficiency of the food business system.
c. Developing facilities, infrastructure, and technology production, post-harvest handling, processing, and storage of food.
d. Building, rehabilitating, and developing food production infrastructure.
e. Maintaining and developing the productive land.
f. Building food production center areas.

The increasing of local food production that must be done by Serang City nicely to establish people's foods need in its area. In addition, Serang City efforts to increase local food production can be done based on Food Security's data from Agricultural Institution in Serang City. It is stated that, the used of Serang City area for agriculture land is wider enough, which is the use of agricultural (riceland) such as irrigation has the greates area with 4,910 hectare(s) from the all areas which are 8,355 hectare(s). Another thing to present is that the use of agricultural land instead of rice fields, garden is the largest with 6,406 hectare(s) of total area 11,747 hectare(s). This should be a capital for Government of Serang City to use existing land, to improve local food production. However, inhibitans who rely on agricultural sector is just 7.77 percent, that means only 20,042 people from 257.861 people in Serang City. This should be attention of the City Government, because lack of human resources whose act in agricultural sector, caused the decrease local food production and the alternative local food of Serang City. Moreover, food availability is related with the improving of government local food production. So in fulfillment right to food the Government need to pay attention both of those things.

Positive effect on region food business will be occur by the increase of local food production. Development of food business system that has been done by the Serang City is by making Community Food Barns (LPM). LPM was formed due to the many problems related to food faced by the community such as poverty, uncertain harvests, and climate problems. It needs food business to meet the food

which needed to closure people and can be managed by the community themselves. In this case, the people who manage the LPM are members of farmer group. Serang City will provide the initial stimulant in the implementation of the community food business system. LPM's system is similar to the savings and loans system in cooperative. Morover, loan in LPM can be in form of rice or grain. So, the members of farmer group who will borrow some grain or rice, will have to repay the loan with same amount and give more with its power. For example, when the farmer have to harvest their farm they have to more struggle to return their loans twice to pay sack of rice to cooperative, it means another sack that he/she gain it will be for themselves as a profit. This program can develop Serang City's food business system.

The fulfillment of need for food is not only through the development of food business system, but other essential things is important too, such as development of facilities, infrastructure, and technology for the production of post-harvest handling, processing, and storage of food. Serang City has a role in management food reserves both government food reserves and community food reserves. The management of government's food reserves and food reserves of District/City is implemented by the Regional Device Work Unit (SKPD) which performs the tasks and performs functions in field of food security. This is based on the mandate of Article 18 (2) of Government Regulation No. 17/2015 on Food Security and Nutrition, in this case, the District/City Government in the implementation can be carried out in cooperation with State-Owned Enterprises and/or Regional-Owned Enterprises in field of food. In the regulation, it has been clearly mentioned that in terms of management of food reserves to realize food availability in Serang City's authority. Based on data from the Serang City Agricultural Service, it is known that to meet the needs of the community, Serang City imports and procures the needs from outside the region, as in the procurement of rice supply mostly obtained from Karawang, Kediri, Lampung, and Cianjur, Private company in Cigading, supply of chicken eggs obtained from Java, Sumatra, Pabuaran, and Petir, and supply of chicken obtained from Anyer, Lampung, Labuan, Pandeglang, and Mandalawangi. Based on research the trading of rice in Serang City tend to resell to market or other big traders, because the existing supply is only focused to meet the needs of rice in Serang City. The rice that goes to Serang City is not just sold to all markets of Serang City and outside its area, but there are also some rice are supplied to big traders in this case restaurant industries which amount 7,500 kg per month. It can be seen that there are big volumes of rice to distribute for recent industry And it is indicated that the rice is not accurately deliver to society who needed. To point out, staple food can be reserved by Government of Serang City currently only rice, it is based on data obtained from the Institution of Agriculture of Serang City. Other efforts that have been done by the Government of Serang City is counseling-extension for farmer groups, whether related to harvest or post-harvest. However, the extension can be done to farmers of farmer group members only. Efforts are made by Government of Serang City in developing food production, facilities and infrastructure done by build, rehabilitate, and develop existing food production infrastructure.

The development of food production infrastructure related are maintain and expand productive land. In Serang City the basic food production infrastructure is agricultural land, so its focused on the development of food agriculture land. The Government of Serang City in expanding productive land, current regulation is still referring to the Regional Regulation of Banten Province No. 5/2014 on Sustainable Agricultural Land Protection. In this situation, development of food production area can build food center in Serang City, it is shown to make society easy in fulfilling the requirement of food in central food production area. But, at this time the food production center area in Serang City has not focused on one place. It still appear divided in several places such as Kramatwatu, Pasar Rawu, and Walantaka. So it takes big efforts to realizing the availability of food especially in establish a food production center.

Inadequate implementation in realizing food availability in Serang City, shows that the Serang City Agriculture Institution does not implement its authority that received by attribution in the provisions of Article 12 (2) of FL, stated that central government and local governments are responsible for the availability of food and the development of local food production in the region. In addition,

implementation in realizing food security in Serang City which is currently implemented by the Institution of Agriculture of Serang City, based on the mandate in article 3 (d) of Serang City Regulation No. 7/2016 about the Establishment and Composition of Serang City Device, stated that the Institution of Agriculture handle of Government affairs in agriculture, marine and fisheries, and food field.

The mandate of Law No. 18/2012 of FL, is Lex Specialis Derogated Lex Generalis with The Guidelines. Based on the FL, the responsible of food availability is obligated to center government and local government. In other hand, it appears on regulation issued by the Guidelines mentioned, regional apparatus of local government whose implementing element of local government administration for food affairs is formed on District/City Institution based on Article 2 (2) of The Guidelines. It is also mentioned in Article 5 (2) that the nomenclature of the District/City named by the Institution, providing food affairs as referred to in Article 2 (2) is called the District Food Security Institution. Compare due the regulation, the guidelines has become first stake on food security institution regulation refers to the FL. It is clear that the Guidelines derogate the FL on food security institution establishment. The implementation of food security affairs currently implemented by the Serang City Agriculture Institution has not as it should be. Implementation of food availability in Serang City has not maximal in the absence of special institutions that handle food security affairs. Furthermore, it can compare on Attachment III of the Guidelines mentions that the duties and functions of the District Food Security Institution, such as :

a. Arraging regional policies in food availability areas, food insecurity, food distribution, food reserves, diversification of consumption and food security.
b. Implementation of local policies in food availability areas, food insecurity, food distribution, food reserves, diversification of consumption and food security.
c. Coordinating provision of infrastructure and support in food availability areas, food insecurity, food distribution, food reserves, diversification of consumption and food security.
d. Improving quality of human resources in food availability areas, food insecurity, food distribution, food reserves, diversification of consumption and food security.
e. Monitoring, supervising, evaluating, and reporting of funds in food availability areas, food insecurity, food distribution, food reserves, diversification of consumption and food security.
f. Implement the administration of Food Security Institution.
g. Implementation of other functions that provided by Regent/Mayor.

Based on the duties and functions in the Guidelines, there are several things not optimally have been implemented by the Agriculture Institution of Serang City, there are :

a. Inadequate supervising and monitoring food safety in Serang City, it can be seen from the activity of food safety surveillance it just has done once a year or before the holy day of recent religion.
b. Implementation of regional policies in food availability areas is not accomplished maximally because Serang City only has a draft of local Food Security regulation.
c. Based on the data obtained, shows that all areas in Banten Province have District Food Security Institution except Serang City. In this case, Serang City does not implement the provisions of function in the Guidelines that related to provision of infrastructure and support in food security areas.

Food Security Institution

The barometer of food security contains four essences, there are food availability, food accessibility, food stability, and food quality. All essences are an integrated system and cannot be beheaded, established one by one. The availability of food will be meaningless, if the quality of food is not accountable. For example too much toxic or not kosher. Moreover, good food quality will be meaningless when there is not accessible, either because of exclusive price or distribution. Next, food stability also never comes true when there is no an intensive relationship (Sunarmito, 2014). Food security in the Food Law is a condition of the fulfillment of food for the state up to the individual, which

is reflected in the availability of adequate food, both quantity and quality, safe, diverse, nutritious, equitable, and affordable and not contrary to religion, conviction, and community culture, to be able to live healthy, active, and productive. So based on that, the local government has a responsibility to realize food security in the region. Since, the important aspect of food security is sustainability, it is necessary to have an institution that plays a role in food security, both hierarchically from central to local and institutional level from the subsystem of availiability, distribution, to consumption. Governments and communities alike have a responsibility in realizing food security as mandated in food related laws. There are many institutions with same interest on food security, both government and private. These institutions can be sufficient, and it is necessary to strengthen the institution's functions and roles to be more effective and efficient performance. Thus, effectively and efficiently the performance of institutions related to food security especially in the regions, can increase the achievement of food security in the area.

Specific institutions, dealing with issues related to food security in respective jurisdictions, shall be in a line with the Guidelines. Mentioned that the regional apparatus of District/City that handles food affairs is in the form of the District/City Institution, and nomenclature of the institution that organizes in the field of food is called the District Food Security Institution. This special institution has the main duty and function that must be implemented in effort to realize food security in the region, therefore it is appropriate for every region to have food security Institution, and do not give the dense duty to other institution to carry out duties and functions of organizing food security. This situation can solve food problems that it can may be a trigger to other sectors problem.

The increase of Serang City population happens annually around at 1.92 percent. It means agricultural land conversion also occurs, and caused primarly, secondary, and tertiary needs are improved. Subsequently, Serang's community consumption level on staple food rose from 1360 tons rice demand in 2015 to 64,281 tons rice demand in 2016. So the role of Serang City in effort food security at least can provide solutions for these problems, especially in meeting the increasing food of the community. Based on activities that have been done by Serang City Agriculture Institution, it can be seen that the number of programs implemented is grant of goods to the community groups in the field of agriculture, plantation and fishery. By conducting grants to other granary groups, hope to be achieved is fulfillment of food of the community. The assistance provided by the Serang City Agriculture Institution is an initial stimulant, to developed and ensure that food availabilities are present and increasing. So, that needs of the community, especially those incorporated in certain groups of agriculture, plantations and fisheries can be fulfilled. However, in practice, there is no addition in initial stock that given by Serang City. This can be interpreted that the role made by the Serang City Agriculture Institution in terms of guidance for the community food barns who receive the grant is not maximal. The non-optimal role of the Serang City Agricultural Institution can also be seen from availability of food in Serang City, which comes from local production can not meet the needs for food of the community. So it is necessary to have specific institutions that deal with issues related food security to perform tasks and functions in the field of food security to maximum level.

Efforts made by the Serang City Agriculture Institution in realizing the availability of food is an effort to realize food security. In the implementation, there are constraints faced. Based on interviews with the Head of Food Division of Serang City Agriculture Institution, said that the constraint is limited budget that is owned by the Institution of Agriculture for implementation of various food security programs. So, that why the programs have been implemented are not maximal. Limited budget and limitations of human resources in the internal SKPD become the main obstacles of Serang City Agriculture Institution in organizing food security. The basic tasks and functions of food security that given to Serang City Agricultural Institution separated on the budget allocation for food security program is not enough, because of the budget is devided to other programs. It shown, that Serang City needs to make other efforts in terms of food/agricultural politics. Politics in sense of fundamental policy as a reference for the long term, meaning that food security programs should be done by the government Institution that specifically handles food problems (Suksmantri *et al.,* 2014). Another

obstacle in implementation of food security, which is not maximal management of food management by the Serang City Agriculture Institution. This can be seen from the insufficient development of local production in realizing availability of food in Serang City. So, it make the supplying food from outside region. With excellent food management despite the limited budget, food security in Serang City still can be realized. Another obstacle is there is no diversity of food reserves that are owned by Serang City and the community, as stated by the Head of Food Division of Serang City Agriculture Institution, the main food that can be reserved in Serang City is only rice.

Many obstacles faced by Serang City Agricultural Institution in organizing food security, indicate that Serang City Agricultural Institution cannot implement the food security in essence. This can also result in availability of food for the community, as there are three sub-systems in food security: food availability, food accessibility, and food security. If in the case of food availability cannot be implemented by Serang City, then other sub-systems will not be executed by of Serang City itself. Because the availability of food can be used as a benchmark in the implementation of food security in area. In addition, availability of food in area will facilitated the people to meet their need, as well as in the city of Serang. If Serang's people has maximized in effort to fulfill their need for food based on local wisdom food, the people will fulfill their need without import food from other areas. Then welfare of the community will establish for farmers and ordinary people.

This food security institution solely aims to implement state duties in the ICESCR (International Covenant of Economic, Social, and Cultural Rights) Convention 2010 related to food security, stated that the task of state is to protect, to respect, and to fulfill. In this case, the fulfillment of the right to food is a state's duty that must be implemented by the government. So, Food Security Institution can be an agency to fulfill the task. Because, in this case, the government has done prevention to its citizens from inability of its citizens in meeting the needs of their food.

CONCLUSION

The conclusion of this study is the authority about availability of food in Serang city accepted with attribution through article 12 (2) of FL to the Local Government. noted that food availability is responsibility of Center Government and Local Government. In matters relating to availability of food based on the mandate of Article 18 (2) of Government Regulation No. 17 Year 2015 on Food Security and Nutrition, stated that in the implementation of food reserve District/City implemented by the Regional Work Units (SKPD) that perform the task or performs functions In food security areas. Serang City Agriculture Institution is now an SKPD who have authority in food security, but in it's duties and functions of Institution of Agriculture dense, it means an independent Institution that charge on food security affairs in specific terms is needed. It is mandated in Article 5 (2) of the Guidlines, stating that the nomenclature of the District/City Institution that administers food affairs is called the District Food Security Institution. So, in the absence of an independent institution whose duties and functions related to food security, Serang City did not implement the Guidlines appropriately.

Constraints to provision of food in effort to implement food security in Serang City, such as budget, less food management, insufficient internal human resources of SKPD that implement food security, caused diversity of food's understanding. Food security is extend issues, it is not only about agricultural sector. Based on article 1(1) of FL, namely food is anything that comes from biological sources of agricultural products, plantations, forestry, fisheries, livestock, and water, whether processed or not processed as food or drinks for human consumption. Therefore the problems in food security sector is a more complex problem than agricultural sector. So, if food security problem related only handled by Agriculture Institution, other obstacles beyond the agriculture cannot be handled by the Institution, to solve the food problem in wider prespective especially in Serang City. Food security has sub system that must be fulfilled that is food availability, food accessibility, and food safety. The most common problem is related to availability of food, so the solution of food availability problem must

be prioritized. If the sub-availability of food is not held maximally, then in implementation of other sub-systems are not optimal.

Suggestion : Increasing population growth almost every year it caused the problem of food needs is rising. An independent institution in charge of food security is required, in line with the mandate of Article 5(2) of the Guidlines, stated that the nomenclature of the District/City Institution that organizes food affairs is called the District Food Security Institution. So, the regulation in food availability which is the authority of Serang City will be implemented maximally with the Regional Device Work Unit (SKPD) that specifically address food security related issues. Given in Banten Province only Serang City which until now has not specific SKPD to handle food security issues.

Food availability includes national food reserves, local food production, and imports of the two main sources are not sufficient for food. Increasing local food production needs to be done by Serang City Agricultural Institution, given the main staple food source of Serang City is mostly obtained from areas outside Serang City. This will be related to food reserves of the Local Government, with given main staple food of Serang City can be reserved at present only rice. Because it is mostly obtained from outside Serang City areas, increase local food production can help diversify in food types of Local Government food reserves.

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CONSUMER PROTECTION OF ILLEGAL FOOD IMPORT ON FOOD SECURITY IN INDONESIA

Sariyah

Faculty of Law, University of Sultan Ageng Tirtayasa, Indonesia

Correspondence e-mail : dharma_033@yahoo.com

Abstract

The increase of illegal food imports that occurred in Indonesia caused disruption of the food security, loss for consumers as well as farmers. The study aims to analyze the protection of consumer law against the illegal food imports and sanctions for illegal importers. The method of this research is qualitative method, with normative juridical research. The result of this research is on consumer protection against illegal food importation regulated in UUPK, Food Law and Government Regulation on Food Label and Advertisement, by using preventive and repressive protection. Sanctions for illegal food importers may refer to the Trade Law, namely administrative sanctions in the form of written warning; suspension of licensing; freezing of licenses; or revocation of Licensing. The suspension of licensing and revocation of licenses shall be submitted to the Inatrade Manager of the Ministry of Trade to block licenses; and published through the Inatrade portal, to be forwarded to the INSW (Indonesian National Single Window) portal. Other sanctions for importers who do not have a marketing authorization shall be imprisoned for a maximum of 2 (two) years or a fine of not more than 4 (four) billion rupiah (Article 142 of the Food Law).

Keywords: Consumer Protection, Illegal Food Imports, Food Security

INTRODUCTION

As stated in the preamble of the 1945 Constitution of the Republic of Indonesia, paragraph 4, the purpose of national development, among others is to protect the entire nation and the entire blood of Indonesia and promote the general welfare. This is related to consumer protection, namely improving the welfare of the people of Indonesia, both material and spiritual, and the availability of basic necessities of good clothing, food and boards (housing). (Sariyah, 2015)

Food is a basic human need that cannot be ignored in everyday life. Without adequate quantity and quality of food and drink, humans will not be productive in their activities. Food issues involve security, safety and health, both physical and spiritual.

According to the Article 1 Paragraph (1) of Law Number 18 Year 2012 on Food (Food Law), it is stated that food is anything derived from biological resources of agricultural products, plantations, forestry, fisheries, livestock, water and water, processed or unprocessed for food or beverage for human consumption, including Food additives, Foodstuffs, and other ingredients used in the process of preparing, processing and/or making food or drink. While food security is the condition of the fulfillment of food for the state up to the individual, which is reflected from the availability of adequate food, both quantity and quality, safe, diverse, nutritious, equitable, and affordable and not contrary to the religion, belief, and culture of society, live healthy, active, and productive in a sustainable manner (Article 1 paragraph (4) of the Food Law).

Food security should include availability, distribution and consumption factors. Food availability factors serve to ensure food supply to meet the needs of the entire population, both in terms of quantity, quality, diversity and safety. Distribution serves to create an effective and efficient distribution system, to ensure that people can get enough quantity, quality and sustainability at an affordable price.

Meanwhile, consumption factor serves to direct the national food utilization pattern to meet the rules of quality, diversity, nutritional content, security, as well as *halal*. (Prabowo, 2010)

The need for food in the world is increasing as the population grows around the globe. However, population growth is not the only problem that hampers the realization of national food security. The threat and challenge for the Indonesian nation to become an independent nation in terms of food is the reduction of agricultural land that is transformed into residential and industrial land.

Food security is one of the most important topics in Indonesia. this issue has major political consequences, in addition to economic and social issues. Food security has become more of a concern since Indonesia became a member of the World Trade Organization (WTO). However, in order to ensure food security, the government must pay attention to the sustainability of food production in the country, but on the other hand, it can not prevent food imports. In other words, if not ready, membership in the WTO could make Indonesia highly dependent on food imports, and this could threaten food security in the country. In principle, food security does not necessarily mean food self-sufficiency, guaranteed imports also determine food security. Food security must be fully supported by its own ability to produce food for the domestic market. Too dependent on imports causes import prices to rise, causing domestic inflation, or exporting countries to stop exports for political or other reasons (Tambunan, 2010)

In order not to be considered resistant WTO, all parties are required to think realistically, and be responsive to the era of free trade. All goods and services originating from other countries should be able to enter Indonesia. However, there are many problems related to the import of goods and services to Indonesia. The problem arises when there is a consumer complaint over the imported goods and services, for example in relation to the problem of simple, quick and low cost settlement mechanisms (Pieris and Widiyarti, 2007)

Therefore, the government must protect its people by providing certainty of food fulfillment by doing self-sufficiency of food for the sake of food security. If domestic food production is insufficient and/or cannot be produced domestically, the government may import food as stipulated in Article 36 of the Food Law.

The fact that there are many cases of illegal food imports, as happened in some border areas in 2016, which reached 2.5 million kilograms. Head of Agriculture Quarantine Agency Banun Harpini revealed that the illegal food imports include 1.669.582 kg of onion, 723,700 kg of rice, 160,269 kg of beef, 3,100 kg of duck meat, and other crops worth Rp 96 billion (_____, 2017). In addition, 17 tons of imported garlic from China and New Zealand, allegedly stockpiled, were confiscated in Bogor. While in Makassar, the Food Unit officer of South Sulawesi managed to uncover the irradiation of refined sugar. The raid on May 20, 2017 successfully saved 107,360 refined sugars sacks each weighing 50 kg or about 5,300 tons. The perpetrator allegedly violates the provisions stipulated in the Trade Act, the Food Law and the Consumer Protection Act (Ikomatussuniah, 2017). Thus, if illegal food imports continue to occur in each year then food security will be disrupted, and it also harms consumers from illegal food and farmers.

Based on the description above, the formulation of the problems is: how the consumer protection from illegal food imports based on legislation for food security in Indonesia? And, what are the sanctions for illegal food importers harming consumers?

RESEARCH METHODS

The type of research adopted in this study is normative juridical as a scientific research procedure to find the truth based on legal logic of science normatively (Ibrahim, 2007). Normative juridical research is also called doctrinal law. Here the law is conceptualized as something written in law (Law in books), or laws that are conceptualized as rules or norms as well as standards of human behavior.. Since this research is a normative study, it is done on written law.

This research uses a *statute approach*. The approach is done by reviewing all laws and regulations pertaining to the legal issues being investigated. The result of the review is an argument to solve the issues faced (Marzuki, 2009).

Data source in this research is secondary data. The data obtained through the material research is classified into 3 characteristics of strength, that is :

1) Primary Legal Material is a binding legal substance consisting of Law Number 8 Year 1999 on Consumer Protection, Law Number 18 Year 2012 on Food, Law Number 7 Year 2014 concerning Trade and Government Regulation Number 17 Year 2015 About Resilience Food and Nutrition.
2) Secondary Law Material. Data that provide explanation of primary legal materials, such as: documents, works of law, reference, and internet articles relating to this research..
3) Tertiary Law Materials. Materials that provide clues and explanations of primary and secondary legal materials, such as: dictionaries, encyclopedias. Dictionary of reference is a Legal Dictionary, Great Dictionary of Indonesian Language, and other Glossary Dictionary (Soekanto, 2010)

Data collection is completed by literature study such as searching, collecting and studying the three legal materials mentioned above (primary, secondary, tertiary). This research uses qualitative data analysis. According Soerjono Soekanto, qualitative approach is a research procedure that produces descriptive data. The data obtained are then arranged in the form of data compilation, to be analyzed, the results are described, and finally, the conclusions are drawn.

RESULTS AND DISCUSSION

Consumer Protection from Illegal Food Imports Based on the Laws and Regulations for Food Security in Indonesia

The term consumer comes from the word *consumer* (English), or *consument*/*konsument* (Dutch). Literally, the meaning of the word consumer is (opposed to producer), everyone who uses goods (Nasution, 2007)

Article 1 Number 2 of Law Number 8 Year 1999 on Consumer Protection (UUPK) stipulates that "the consumer is any user of goods and/or services available in the community, whether for self-interest, family, other people, or other living organisms , and not for trading".

The elements of the consumer are everyone (the subject referred to as the consumer means any person or legal entity having the status of a user of goods and/or services); User (explanation of Article 1 Number (2) UUPK, the word "user" emphasizes, the consumer is the ultimate consumer, goods and/or services (goods as any object, tangible or intangible, whether mobile or immovable, either expendable or non-consumable, which can be traded, used, used, or utilized by consumers. On the other hand, services are defined as any service in the form of work or achievement provided for the community to be utilized by consumers); available to the public (goods and/or services offered to the public must be available in the market) and for self-interest, family, other people, other living beings (this interest is not intended solely for self and family, but also goods and/or it is necessary for others, even for other living things such as animals and plants); and the goods and/or services are not for sale (Kristiyanti, 2008).

To meet the needs of daily food, consumers rely on business actors. Definition of business actor in Kamus Besar Bahasa Indonesia (KBBI) is *mereka yang menghasilkan suatu bahan atau barang, atau mengelola suatu jasa untuk digunakan oleh pihak lain (konsumen)*/ those who produce a material or goods, or manage a service for use by another party (consumer) (Diknas, 2005).

Article 1 (3) UUPK determines that the business actor is any individual or business entity, whether in the form of a legal entity or non-legal entity established and domiciled or conducting activities within the jurisdiction of the Republic of Indonesia, either single or jointly through an agreement conducting business activities in various economic fields. In the explanation of this article it

is explained that the business actors in question are companies, corporations, State-Owned Enterprises, cooperatives, importers, traders, distributors and others (Kristiyanti, 2008).

Today, consumers are more interested in buying imported food than domestic products. The reason is because the price is more affordable, better quality, more prestigious, and so on. Without considering whether the import is legal or illegal. Because the word illegal means invalid; not legal; not according to law, so illegal importation is the activity of importing goods to Indonesian customs area not in accordance with applicable law. Import of goods is an activity of entering goods into customs area (Article 1 (4) UUPK), whereas according to Article 1 (25) of Food Law, Food Import is activity of entering food into customs area of Republic of Indonesia covering land area, , and air space above, certain places in the exclusive economic zone and the continental shelf.

The large number of illegal food imports in some parts of Indonesia, such as those in Batam and Bogor, has caused consumers to be weak and have no high bargaining power when illegal imported food spreads in the market. The impact is the result of domestic agriculture is not sold, and the farmers are harmed. If farmers lose, food security will be disrupted.

The activity of entering goods into Indonesian customs area is different with the activity of sending goods out of the area. Although such activities are the same in relation to International trade transactions, but the activities of entering goods into Indonesian customs areas involve the interests of consumers who need to be protected (Miru and Yodo, 2004)

Article 1 point 1 UUPK affirms that consumer protection is any effort that ensures the existence of legal certainty to provide protection to consumers. Consumer protection measures are more intended to increase the dignity and awareness of consumers and/or at the same time intended to encourage business actors in carrying out their business activities carried out with a sense of responsibility.

Consumer protection law is not only the concern of the Indonesian government, but also other countries, including Germany, Republic of China (Taiwan), United kingdom, and other commonwealth countries such as Australia, New Zealand and the United States (Sadar *et al.,* 2012)

Theoretically, according to Philipus M. Hadjon as described by Salim, the form of legal protection is divided into two, namely preventive, and repressive. Preventive legal protection is a preventive legal action. Protection provides an opportunity for the people to file an objection (inspraak) on his opinion before a definitive government decision. Thus, legal protection aims to prevent the occurrence of the disputes. This preventive law protection encourages the government to be careful in making decisions relating to the principle of *freies ermessen*, and the people may object to or be consulted about the decision plan. While repressive legal protection serves to resolve in case of the dispute (Salim and Nurbani, 2013)

There are five principles in providing legal protection to consumers. Clear principles and goals provide a strong foothold against consumer protection laws. Consumer protection is organized as a joint venture of all related parties, communities, business actors, and governments. According to Article 2 UUPK, there are five principles of consumer protection, which include, firstly, the Principle of Benefit, ie consumer protection must provide maximum benefit, both for the benefit of consumers and for the entrepreneur as a whole; secondly, the principle of justice provides an opportunity for consumers and business actors to obtain their rights and to perform their obligations fairly; third, the principle of balance is to provide a balance between the interests of consumers, business actors and governments in the material or spiritual sense; fourth, the Principle of Consumer Safety and Security is to provide consumer safety and security for the goods and services used; and finally, Principle of Legal Certainty that business actors and consumers must obey the law and obtain justice, where the state guarantees legal certainty.

Consumers have the rights as stated in Article 4 UUPK, namely the right to security, comfort and safety in consuming goods and/or services; the right to choose goods and/or services and obtain the goods and/or services in accordance with the exchange rate and the conditions and promised warranties; right to information that is true, clear and honest and in accordance with conditions and

guarantee of goods and/or services; the right to be heard of his opinions or his complaints on goods and/or services; the right to adequate advocacy, protection and dispute resolution efforts; Right to education and consumer education; The right to be treated or served properly and honestly in a non-discriminatory manner; The right to compensation, indemnification and/or reimbursement, if the goods and/or services received are not in accordance with the agreement, or not as they are and the rights provided for in other laws and regulations.

Article 7 of the UUPK determines the obligation of business actors/importers, ie having good intentions in conducting their business activities; provide true, clear and honest information about the condition and guarantee of goods and/or services and provide explanations of use, repair and maintenance; treat or serve consumers properly and honestly and non-discriminatively; guarantee the quality of goods and/or services produced and/or traded under the provisions of the applicable quality standards of goods and/or services; provide an opportunity for consumers to test, and/or try certain goods and/or services and provide guarantees and/or warranties on manufactured and / or traded goods; compensate, indemnify and/or reimburse for losses arising from the use, use and utilization of traded goods and/or services; and compensate, indemnify and/or reimburse if the goods and/or services received or utilized are not in accordance with the agreement.

Article 26 of the Law Number 69 year 1999 on food labels and advertisements specifies that names and addresses of those producing food shall be included on the label. The name and address of the party importing food into the territory of Indonesia on the label shall also be listed. This provision is intended for consumers to obtain information about the producers of origin and the importers of food.

Based on the theory of legal protection that the consequences of illegal food import is that it can harm consumers. These consumers can use preventive protection, namely by filing objections to the government related to the rise of illegal food imports. Repressive protection can be guaranteed when consumers experience a loss due to consumption of illegal imported food by way of filing their objection to the court or BPSK (Consumer Dispute Settlement Agency).

Long-term and short-term policies are needed to ensure the sustainability of food security through increased availability of national food, especially rice, as well as improving the welfare of farmers. For the long term, the import restriction policy can be reduced gradually. Nevertheless, the policy of increasing domestic production is still needed with the improvement of Domestic/Local Food Security. Sedangkan untuk jangka pendek diperlukan kebijakan perlindungan petani dengan pembatasan impor produk pertanian. This needs to be supported by policies that encourage increased domestic production through efforts to increase the productivity of national agricultural products. Meanwhile, to prevent illegal food imports, strict supervision of border areas and small ports is required.

Elites government is the main actor in food import policy which is dominated by actors from food institutions. The actors come from different institutions and political parties that bring and accommodate their respective political interests through regulation (Riawanti, 2015)

Sanctions for the Illegal Food Importers Adverse to the Consumers

A general explanation of the Food Law states that food business actors must meet various provisions regarding food production activities or processes when doing food production, so as not to risk harm or harm human health. The food business actor is responsible for the food he/she distributes, especially if the food produced causes harm to both health and the death of the person consuming the food. Article 33 Paragraph (1) of the Trade Law stipulates that Producers or Importers who do not comply with the provisions on the registration of Goods shall terminate the activities of the Trade in Goods and withdraw the Goods from distributors; agent; wholesaler; retailer; and/or consumers.

Article 46 of Law Number 7 of 2014 concerning Commerce determines that the Importer is solely responsible for the Imported Goods. Irresponsible importers shall be subject to administrative sanctions in the form of revocation of licenses, approvals, acknowledgments and/or stipulations in the field of Trade; and further provisions concerning procedures for imposition of administrative sanctions shall be regulated in a Ministerial Regulation.

The regulation in this case the Regulation of the Minister of Trade of the Republic of Indonesian Number 36/M-Dag/Per/5/2016 Regarding Procedures for Imposing Administrative Sanctions for Exporters and Importers. Exporters or importers who violate the provisions of laws or regulations in the field of export or import shall be subject to administrative sanction in the form of written warning, suspensions of permissions, license suspension or revocation of licensing. The imposition of administrative sanction is done in 2 (two) ways, ie gradually and not gradually. A gradual administrative sanction, imposed in the form of a written warning, a license freeze, and license revocation. While administrative sanctions imposed not gradually, can be directly in the form of suspension licensing, licensing freezing and licensing revocation. Imposition of administrative sanctions may be given on the basis of a complaint reports, post audit results, evaluation results, and/or results supervision. The imposition od administrative sanctions is the authority of the Minister, Director General or Licensing officers, in accordance with the provisions of the law.

Any imposition of administrative sanctions in the form of freezing of Licensing and License revocation shall be submitted to the Inatrade Manager of the Ministry of Trade in order to block licensing; and publicly announced through the Inatrade portal of the Ministry of Commerce to be forwarded to the INSW (Indonetion National Single Window) portal. Inatrade is a service to request online, and report on export/import realization. INSW is a nationally integrated electronic system, accessible via the Internet network, and will integrate information relating to the process of handling customs documents and other documents related to export/import activities, to ensure the security of data and information between internal systems automatically, This includes customs clearance, licensing, port/airport system, and other systems related to service process and supervision of import export activities.

Article 37 of the Food Law states that food imports carried out to meet domestic consumption needs shall meet the requirements of security, quality, nutrition, and not contrary to the religion, beliefs and culture of the community. Every person who imports food for trade shall meet the standards of Food Safety and Food Quality (Article 93 of the Food Law).

A food business actor who intentionally does not have a marketing authorization for any processed food made domestically or imported for trading in retail packaging, shall be subject to a maximum imprisonment of 2 (two) years or a maximum fine of Rp. 4,000,000,000.00 (four billion rupiah). This is regulated in Article 142 of the Food Law.

Based on the above legislation, there is no article explicitly regulating sanctions for illegal food importers. Therefore the government should revise the related law and include strict sanctions regulation for the illegal food importers.

How the form of responsibility of food business actors to the losses arising and suffered by society is not regulated in the Food Law. In such circumstances it can be interpreted that the realization of the responsibility of the producers of food business to the harm suffered by the consumer society using other laws and regulations applicable to the mechanism as regulated in the other legislation. In this case can be used provisions of the Civil Code about demanding compensation or UUPK (Sidabalok, 2014)

Laws of producer responsibility applicable to each country vary. Various countries, especially for developed countries and the international world have made legal reforms related to product liability (responsibility of producers), especially in order to facilitate the provision of compensation for consumers who suffer losses due to products distributed in the community. The producer's responsibility is a form of legal liability of the person or entity that produces a product, or from the person or entity that sells or distributes the product.

According to Celina Tri Siwi Kristiyanti, *Product Liability* is a legal responsibility of a person or body that produces a product or from a person or entity engaged in a process to produce a product or from a person or entity that sells or distributes such product (Kristiyanti, 2008)

In addition, in the world of commerce today, a product that reaches the consumer does not occur directly from the producers, but through various intermediary channels. This situation will

complicate the victims / consumers who will make a claim for losses suffered. If the series between producers and consumers goes beyond national state boundaries, the legal issues will be even more complex. The reasons why strict liability principles apply to the law regarding product liability include (Rajagukguk *et al.,* 2000) :

1. Between the victims/consumers and producers, the burden of loss (risk) must be borne by the party producing/issuing the defective/dangerous goods on the market.
2. By placing/distributing goods on the market, the producer guarantees that the goods are safe and appropriate for use, and where proven to be infringing, they shall be held accountable.
3. Manufacturers who make mistakes can be prosecuted through the prosecution process even without applying the principle of mutual responsibility. ie from consumers to retailers, retailers to wholesalers, wholesalers to distributors, distributors to agents, and agents to producers. The application of *strict liability* is intended to eliminate such long processes.

The principle of absolute responsibility in consumer protection law is generally used to ensnare business actors who market products that harm consumers. The three pillars of stakeholder responsible for food safety in "safe food for all" are government, consumer, and business/industry. Understanding consumer protection means realizing the relationships of various dimensions that each other has a linkage and interdependence between consumers, employers and governments (Holijah, 2014)

Based on the above description, regulations relating to the protection of consumer law, food imports, food security and sanctions for illegal food importers are included in the Food Law, UUPK, Trade Law and its implementation regulations. The law enforcement of these rules, in this case, is indispensable to the public.

In principle, the Law belongs to Allah SWT, because man in the eyes of God is equal, then man has the same rights and obligations before the law. Law enforcement is necessary to bring about justice in society. Allah Almighty obliges man to establish law with justice (Kemenag, 2014)

CONCLUSIONS

Accordingly, Consumer protection against illegal food importation is regulated in UUPK, Food Law and PP Label and Food Advertisement. Legal protection for consumers who are disadvantaged by illegal food imports is made by using preventive protection ie consumers can file their objection to the government related to the rampant illegal food importation. Repressive protection can be implemented when consumers experience a loss due to consumption of illegal imported food by filing a court or BPSK (Consumer Dispute Settlement Agency). Sanctions for illegal food importers are regulated in the Trade Law, namely administrative sanctions in the form of written warning; suspension of licensing; freezing of licenses; or revocation of permissions. The freezing of licenses and the revocation of licenses shall be submitted to the Inatrade Manager of the Ministry of Trade to block licenses; and announced to the public through the Inatrade Trade Ministry's portal to be forwarded to the INSW (Indonetion National Single Window) portal. The Food Law determines sanctions for importers who do not have a marketing authorization with a maximum penalty of 2 (two) years, or a fine of not more than 4 (four) billion rupiah. The suggestion is that the government, in this case the Police and customs, to immediately close any illegal food entry routes to Indonesia, because it is very harmful to consumers/farmers. Local governments are expected to control food prices and government, and private oversight synergies need to be improved.

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