Local foods development to achieve food security in Papua Province, Indonesia

Rida Akzar¹, Achmad Amiruddin², Riri Amandaria³, Rahmadanih², and Rahim Darma²
¹PhD student, Centre for Global Food and Resources, The University of Adelaide, South Australia,
²Department of Agricultural Socio-economics, University of Hasanuddin
³Department of Sociology, University of Hasanuddin

E-mail: rida.akzar@adelaide.edu.au

Abstract. This study describes the problem of high dependency on rice consumption in Papua while Papua has several local foods as alternative sources of carbohydrate. The study focuses on Papua province as the region that has many potential on local-non rice food like corn, cassava, and sweet potatoes, which then selected as the study objects. A ten-year series of data from 2006 to 2015 was obtained from BPS (Central Bureau of Statistics) and analyzed in this study. The results show that the development of local food was relatively slower in Papua Province compared to the national level, except for fish development. It is observed that the program to increase rice production is very intensive while the program to increase local food production has not been a concern of the local government. Programs to increase production, develop cultivation, production, and processing technologies are biased to rice production, resulting in the food diversification program through local food development is likely difficult to be realized. Papua Province has a comparative advantage in local food because it is supported by the potential of natural resources and the culture of local community. Local food must be encouraged and promoted as a major, healthy food source and at the same time, support the realization of food diversification programs in Indonesia.

1. Introduction
Papua Province is one of the poorer provinces in Indonesia that is located in the East of Indonesia. Based on the data from Statistics Indonesia of Papua Province (2014), the total number of poor people in Papua Province is 864,100 in urban and rural areas or 27.80% of the total 3,091,047 population. The Indonesian Food Security Agency-IFSA (IFSA 2012) presents that Papua Province ranks lowest score of Household Dietary Diversity Score (HDDS) with a score only 69.6 out of 100 (the highest score) in 2011. Lower score indicates the least variation of foods consumed by a household. Kennedy, Ballard, and Dop (2011) identify the HDDS as the economic access of households to acquire a diversity of foods [1]. They define economic access as a socioeconomic status that would relate to food security at the household level.

The low score in Papua Province reflects that the consumption pattern of the household is not diverse and still depends on rice as the only source of carbohydrate. This could happen due to a lack of economic access to acquire a variety of foods. Rice consumption contributes 73.9% of people’s diet...
in Papua Province followed by 9.7% wheat, 6.2% sago, 5.2% cassava, 2.4% sweet potato, 2.2% tuber crops, corn 0.4%, and potato 0.1% [2]. Furthermore, the price disparity of staple foods in Indonesia showed a gap for a higher rice price in Papua Province compared to other provinces, for instance, rice price in Papua Province is 30% higher than in Aceh Province [3]. The high price of rice is caused by a lack of production and expensive transportation costs for food because the area is mountainous.

The geographical condition of Papua province is one of the causes of food problems. Food problems can be overcome through local food development. Local food is a cultural food and at the same time, a major food source before the peak of the success of the revolution in Indonesia. Local food can be defined as locally grown plants based on local wisdom, culture, suitability, local climate, and people's diet [4,5]. The objective of this study is to describe the potential of local food that can be developed to encourage food diversification and achieve food security. Local food development and food industrialization movement is the approach to overcome food and energy crisis as well as to reduce the GHG emissions [6]. The diversity of local Papuan foods is the potential to change people's diets so that they can turn to non-rice foods while still meeting their carbohydrate needs. Local food development can ensure a constant supply of food in the domestic market, ensuring people to have economic access to food, ensuring people to consume nutritious food, and maintaining food security stability in the province of Papua and the national level.

2. Methods
Papua province has several carbohydrate alternative sources such as sago, millet, sweet potato, cassava, corn, and other root crops [7]. This commodity can be developed as a staple food or an alternative source of carbohydrates besides rice and at the same time realizing food security [8,9]. Food security definition based on the 1996 World Food Summit is "a condition when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life" (FAO 2006). There are four pillars of food security -availability, access, utilization and stability (FAO 2006). These pillars are guidelines which can be prepared and adopted through local development, so that food availability can continuously be realized. These four pillars can be easily met by developing local food. Non-rice food demands are continues to increase in line with the transition in community preferences for diversification of carbohydrate sources and public awareness of environmental preservation. By preserving local food, this movement also supporting the conservation on local plants and won't be affected by la-nino and el-nino climate change [10].

This study aims to describe the prospect of developing local food to reduce food dependence on rice by analyzing the development of rice, non-rice, and fish food as the main carbohydrate and protein sources, respectively. Describing the prospect on developing local food to reduce food dependence on rice by analyzing the development of rice, non-rice, and fish as the main food carbohydrate and protein sources was the goals of the studied rice, corn, cassava, and sweet potatoes was taken as study objects since these commodities can be cultivated in the study site, also have a role as a staple food source and or alternative food. The data used for the analysis obtained from BPS (Central Bureau of Statistics) with the ten-year series 2006-2015.

3. Results and Discussion
3.1. Study Site
The geographical condition of Papua Province is dominated by mountainous areas. As a result, transportation and distribution costs are expensive as areas can be predominantly only reached by airplanes and helicopters. Papua has high potency on sweet potato production, which the production reaches 318,399 tons or five times more than rice production, which is only 61,923 ton, according to The Government of Papua Province-GPP (GPP 2015). The total potential arable land is 14,269,376 hectares where cultivated and uncultivated land is 190,623 hectares and 14,078,744 hectares (98.66%) respectively (GPP 2015). The high amount of uncultivated land shows a high possibility of further development on local crops in Papua to achieve food security in the regional level.
Rice consumption and production of Papua were 65 and 394 thousand tons, respectively, that resulted in a deficit of rice balance sheet by 329 thousand tons in 2011 (Jati 2014). High dependency on rice would become a problem since Papua does not have a comparative advantage in rice production. This study will encourage the development of stakeholders that local food development in Papua Province may reduce dependency on rice towards food security through the revitalization of local food development.

3.2. Food development

Indonesia is a tropical agricultural country where most agricultural products can be grown [11]. Indonesia was declared successful in implementing a green revolution so that food self-sufficiency on rice was realized in 1984 by changing the pattern of community food consumption from diversification of various food sources to rice. In 1960, was the beginning of the implementation of the green revolution, where the population was considered not prosperous if the main foodstuff was not rice. Aspects of view and the accomplishment of the green revolution generated some negative impacts on various aspects [12]. Intensive use of external inputs made from chemicals and genetic engineering, which creates dependence on farmers and environmental damage, changes the population's diet from diversification of staple foods to rice dominance and disruption of environmental balance due to the extinction of several species by chemical use. Transition in consumption patterns and staple foods, which are dominated by rice, obliterates Indonesia as the largest rice importer in the world.

Food diversification based on local wisdom began to be promoted in the 1990s after the social, economic, and environmental impacts of the green revolution were realized [13]. Food diversification in Indonesia is still an issue because it's handling in the form of community movements, not in the form of development programs [12].

The declaration of food diversification has been going on for nearly 30 years. However, the food development program still relies on rice to meet the increasing needs of the population. Government policies tend to be biased in rice production [14]. The program to increase food production runs as it planned, it results in a continuous increase in production. The level of rice food growth tends to decrease, on the contrary, the growth rate of non-rice food has increased in Papua Province (Table 1).

| Year | Indonesia Rice | Indonesia Non-Rice | Papua Province Rice | Papua Province Non-Rice |
|------|----------------|-------------------|---------------------|-------------------------|
| 2006 | 54,454,937     | 33,450,341        | 60,810              | 313,999                 |
| 2007 | 57,157,435     | 35,162,437        | 68,319              | 335,092                 |
| 2008 | 60,325,925     | 39,956,004        | 81,678              | 348,307                 |
| 2009 | 64,398,890     | 41,726,806        | 98,511              | 386,612                 |
| 2010 | 66,469,394     | 42,245,754        | 102,610             | 391,499                 |
| 2011 | 65,756,904     | 43,883,308        | 115,437             | 390,222                 |
| 2012 | 69,056,126     | 46,047,854        | 138,032             | 388,167                 |
| 2013 | 71,279,709     | 44,835,503        | 169,791             | 451,455                 |
| 2014 | 70,846,465     | 75,397,841        | 196,015             | 181,769                 |
| 2015 | 75397841       | 43,711,484        | 181,769             | 499,979                 |
| Growth 2006-2010 | 3.88 | 5.66               | 13.83               | 4.52                    |
| Growth 2010-2015 | 2.60 | 6.46               | 12.65               | 26.16                   |

Table 1. The number and growth of rice and non-rice food, 2005-2015 (ton).
Table 1 shows that the food growth rate in Papua province for rice is higher than the growth rate at the national level. Non-rice food growth continues to increase with a higher growth rate than rice food. In contrast, rice food growth has declined, both in Papua Province and at the national level.

Level of rice production has not been able to meet the needs of the population that continue to rise. Indonesia's rice consumption is around 130 kg per capita and is the highest in the world after Vietnam, resulting in more than one million rice imports annually [12]. The development of non-rice food production cannot be encouraged when viewed from the aspect of food diversification. Corn, as one of the non-rice food commodities that dominate growth, also experienced a shift from being a food ingredient to be animal feed ingredients. The aim of the program is to alter corn production and to encourage consumption of animal protein through augmenting the livestock production.

In addition, to escalate corn production, food production is still dominated by rice, both in Papua Province and nationally. These commodities obtained serious attention from the government in the form of food production improvement programs, while other non-rice food commodities, almost do not have programs such as rice and corn. The province which has the potential of natural resources for local food development, # turns out the stride in non-rice food lower than the national level, in fact, Papua province also encourages intercalation in rice production that exceeds the growth of national rice production.

| Table 2. | The number and average changes in population and food (2005-2015). |
|-----------|---------------------|---------------------|---------------------|---------------------|
| Description | Indonesia | Papua Province | Indonesia | Papua Province |
| | 2015 | Change 2006-2015 (%) | 2015 | Change 2006-2015 (%) |
| Penduduk (person) | 255,461,700 | 1.66 | 3,149,400 | 5.11 |
| Rice (ton) | 45,238,704 | 4.27 | 109,061 | 18.45 |
| Non-rice (ton) | 43,711,484 | 3.41 | 499,979 | 5.47 |
| Maize (ton) | 19,612,435 | 7.66 | 6,666 | -0.29 |
| Sweet potato (ton) | 2,297,634 | 2.66 | 446,925 | 5.99 |
| Cassava (ton) | 21,801,415 | 1.01 | 46,388 | 2.52 |
| Fish (ton) | 6,677,802 | 4.33 | 232,564 | 0.36 |
| Marine Fish (ton) | 6,204,668 | 4.17 | 221,340 | 0.15 |
| Freshwater fish (ton) | 473,134 | 6.17 | 11,224 | 7.03 |

Table 2 shows that the increase in rice production in Papua Province was high enough to meet the needs of the high growth population. Papua province is one of the destination areas for migration to find work for some residents in Indonesia, so the population has experienced a large accretion [15]. Papua is one of the 34 provinces in Indonesia with a population proportion of 1.23 percent and the lowest proportion of foodstuffs on 0.24 percent for rice and the highest 19.45 for sweet potatoes of total production in Indonesia.

3.3. The Availability of Food

Food availability for the population tends to decrease due to relatively large population growth (Table 2). There is a good picture in Papua Province that the level of sweet potato availability is still high. Sweet potatoes are a staple and a culture for alternative carbohydrate sources [16]. In addition, the availability of fish as food as the main source of protein is higher compared to the national level. Papua Province, also potential on fish whether it be sea fish or freshwater fish. There is a large swamp area with lots of fish population so that it can be caught easily at any time. Conversely, fishing at sea is mostly done by fishermen from outside, and most of the fish catch is not consumed by the Papuan people.
Table 3. The availability of food (rice, non-rice, sea fish, and freshwater fish 2006-2015 (kg/capita).

| Description       | Indonesia 2016 | Growth 2006-2016 (%) | Indonesia 2016 | Growth 2006-2015 (%) |
|-------------------|----------------|-----------------------|----------------|-----------------------|
| Rice              | 127.90         | -2.13                 | 112.13         | -5.17                 |
| Non-rice          | 130.94         | -2.18                 | 106.40         | -42.29                |
| Maize (ton)       | 45.45          | -0.76                 | 2.17           | -0.86                 |
| Sweet potato (ton)| 7.26           | -0.12                 | 92.22          | -36.66                |
| Cassava (ton)     | 78.24          | -1.30                 | 12.01          | -4.77                 |
| Fish              | 1.66           | 1.48                  | 117.81         | 0.36                  |
| Sea fish          | 1.61           | 7.47                  | 112.13         | 0.15                  |
| Freshwater fish   | 0.05           | -10.23                | 5.69           | 7.03                  |

Table 3 shows that almost all food items have experienced a reduced level of per capita availability, except fish. Nationally, the availability of fish has increased, except for freshwater fish, which has decreased. Nationally, Papua Province shows the level of fish availability per capita is much higher than the national level, especially freshwater fish. Papua province has a fairly wide swamp area and is still conserved so that freshwater fish are available and easily caught with simple fishing tools.

The disadvantage of non-rice food is that the process of serving food is relatively complicated compared to rice. A cheap and easy technique for preparing non-rice food is still limited, this is one of the factors that may cause non-rice food to be less desirable. Indeed, many residents like to consume non-rice food, especially for residents who have a high level of health awareness. Fish, as the main source of protein for Indonesia's population, has great potential in the Papua Province. The availability of fish can encourage a variety of alternative food consumption besides rice.

Changes in this ratio indicate that the potential and comparative development between rice and non-rice food, including the development of fish and food. These indicators show the comparison of the rate of development of the two foodstuffs. Besides, it can also describe developments that can encourage or inhibit local food-based food diversification. The rate of availability of rice is faster compared to non-rice food, except the rate of development of fish on food. National food development is still faster than food development in Papua province, both for rice food and non-rice food.

Table 4. The growth of the ratio of non-rice food to rice and fish.

| Description           | 2006 | 2016 | Growth (%/year) |
|----------------------|------|------|-----------------|
| **Indonesia**        |      |      |                 |
| Ratio of Nonrice/Rice| 1.08 | 1.02 | -5.54           |
| Ratio of Fish/Rice   | 0.155| 0.16 | 0.35            |
| Ratio of Fish/Total Food | 0.05 | 0.58 | 0.05 |
| **Papua**            |      |      |                 |
| Ratio of Nonrice/Rice| 6.96 | 4.36 | -37.42          |
| Ratio of Fish/Rice   | 5.991| 3.06 | -49.00          |
| Ratio of Fish/Total Food | 0.69 | 51.57| 0.69 |

Table 4 shows that the rate of fish growth is faster in Papua Province compared to the national level. Rice food development is faster than other food developments. The rate of progress on rice in
Papua is faster than non-rice food. This data shows that the growth of local food in order to encourage food diversification is getting harder to realize.

4. Conclusion and Policy Recommendation
Local food progress is relatively slower in Papua Province and the national level, except for fish development. The rice development program is intensive, while the local food production improvement program has not become the government's attention. The program to increase production, evolve cultivation technology also produce processing is still limited to non-rice food, so local or non-rice food cannot take part in supporting the food diversification movement. Local food diversity as a source of carbohydrate has a huge impact on reducing the dependence on rice for food security. Local food development will benefit local communities to strengthen the pillars of food security. The cost of producing and distributing local food will be lower because the seeds and plants are distributed locally. Papua Province has a comparative advantage in local food because it is supported by the potential of natural resources and the eating culture of local people. Local food must continue to be encouraged and promoted as the main, healthy food source and at the same time, support the revitalization of the food diversification movement in Indonesia.

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