SMCC Higher Education Research Journal
ISSN Print: 2449-4402 · ISSN Online: 2467-6322
Volume 8 · January 2021 · H Index = 3 from Publish or Perish

Land-Use Conversion Rice Production and Food Security

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Gunning Fog Index: 12.60 • Originality: 99% • Grammar Check 99%
Flesch Reading Ease: 47.00 • Plagiarism: 1%

ABSTRACT

As the world population increases drastically, the land-use conversion of agricultural land to non-agricultural uses is massively observable in highly urbanized cities. The study was conducted to describe the impact of the land-use conversion on rice production and food security in Butuan City from 2014 to 2016. The city has a total land area of 81,728 hectares with rice production areas of 8,141.44 hectares which is 10.038 percent of the entire land area. It also investigated the Local Government Unit support on the development and thrust and policy support, the profile of the land use classification, farmers' distribution, rice field conversion rate, rice production through harvest, and food security in terms of price and stocks. The results of the study revealed that there were already 89.031 hectares of agricultural land permanently converted to non-agricultural use. Rice production in the city could not sustain the daily rice requirement to its population, and rice farmers are quite dissatisfied with the provision and programs of the city government. It was recommended that the Local Government of Butuan City should review the City Zoning or land use plan and adapt Agricultural Land Protection Program that would ensure farmers' productivity and food security in the city.

KEYWORDS

Land use conversion, rice productivity, food security,
descriptive correlation, Philippines

INTRODUCTION

As As the world population increases drastically, the land-use conversion of agricultural land to non-agricultural uses is massively observable in highly urbanized cities. This incessant conversion could threaten rice production as the main source of food security in many countries. Rice is the staple food for over half the world's population. Approximately 480 million metric tons of milled rice are produced annually. China and India alone account for more than 50% of the rice grown and consumed. Rice provides up to 50% of the dietary caloric supply for millions living in poverty in Asia and is, therefore, critical for food security (Muthayya et al., 2014)

Land-use changes are strongly influenced by globalized flows of commodities, information, capital, and people. They are increasingly driven by factors in distant markets, often associated with the growing urban consumer class in emerging markets. Local to national-scale interventions to promote sustainable land use may have unintended effects abroad due to land use displacement across countries (Meyfroidt, 2013). Matthies & Karimov (2014) point out the role of financial drivers is economic growth, technological development, population growth, and climate change.

Land use and food security through rice production are interrelated in the Philippines. It emphasizes that food security depends not only on increasing production and quality and ensuring access and utilization of agricultural technology but also on local external drivers of change such as the political, economic, and human context at regional, national, and territorial levels significant role. It entails why it is so difficult to reach food security.

There was more urban development in the southeast area because of the lower prices for agricultural land for residential sub-division developments and the strong preference among tenant farmers there for land use conversion over continuing farming. This preference was due to agricultural lands' low efficiency and productivity because of insufficient irrigation for the rice crops grown there (Malaque & Yokohari, 2007).

FRAMEWORK

This study is anchored on the theoretical assumptions of the Law of supply and the law of demand (Marshall & Guillebaud, 1961). The law of supply and the law of demand explains the interaction between the supply of a resource and the demand for the resource. When the supply is scarce, the demand is higher. When there is an overproduction, the demand decreases. Therefore, the price of the product is directly affected depending on the supply of the producers and the demand of consumers.

When it comes to industrialization and urban housing, the law of supply demonstrates the quantities sold at a certain price. This means that the higher the price, the higher the quantity supplied. Producers supply more at a higher price because selling a higher quantity at higher price increases revenue.

When this theory is applied to land-use conversion, rice production, and food security in Butuan City, this will explain the extent of the demand for rice as a staple food and the demand of land areas for industrialization as it rapidly develops into a highly urbanized city. A decent subdivision of 7 hectares used to be a rice field is now turned into 200 single-detached houses. Real estate developers take advantage of the demand for housing facilities in the central part of Butuan.

The demand for housing facilities prompted some landowners and farmers to sell or convert their rice fields to non-agricultural uses to ride on the accelerating demand for urbanization. Rice production through harvest and food security will be severely threatened as rice fields are converted and rice production decreases (DARO, XIII, 2017).

As the population increases at the rate of 1.48 percent annually (PSA, 2015), the demand for rice gets higher because babies begin to consume semi-solid food as early as eight (8) months (FNRI-DOST, 2017).

The framework shows the relationship of land use conversion, rice production, and food security in Butuan City. Land use conversion implementation aligned through Development thrust and Policy Support from the city of Butuan. The extent of Land Use Conversion manifested on the Land Use Classification, farmer distribution, and the rate of rice field conversion.

The impact of Land Use Conversion can be seen in the volume of rice production through palay harvest, which is a direct source of food security of the city. Land use conversion decreases the arable land for rice fields, decreasing rice production for food security.

Food Security manifested in enough supply of commercial stocks in the market, household stocks for every family, and buffer stocks in disasters and calamities. Rice production is critical for food security which means rice security is equivalent to food security because rice is the most important human food. Sustained production of rice is the fulfillment of food security.

Regulated or minimal land-use conversion of rice fields is perceptible through higher rice production, more sustainable buffer stocking for food security, and price affordability.

OBJECTIVES OF THE STUDY

The study was conducted to determine the relationship between land-use conversion and rice productivity and food security of Butuan City for the crop year 2014 to 2016 and describe the impact of the land-use conversion on rice production and food security in Butuan City as perceived by rice farmers and Local Government officials.

METHODOLOGY

Research Design

The study used the descriptive correlation method to assess the relationship between land-use conversion and rice productivity, the relationship between land-use conversion and food security, and qualitative information supported in the interpretation of quantitative data. The statistical correlation measure provided the researcher the means to interpret and compare the relationship between land use conversions by evaluating the status of rice production and food security. Descriptive research allowed the researcher to describe, compare, interpret, and verify the gathered data.

Research Locale

This study was conducted in 86 clusters of Butuan City. The Local Government Unit officials are well represented in this study.

Research Respondents

The research respondents included the 52 rice farmers and or landowners who have sold their land or have converted their farms for non-agricultural use from the ten (10) barangays with approved land use conversion based on the cumulative report of DAR as of June 2017, and the 24 respondents came from the Local Government Unit of Butuan City. The researcher used the complete enumeration procedure in choosing the respondents of the survey.

Research Locale

This study was conducted in 86 clusters of Butuan City. The Local Government Unit officials are well represented in this study.

Research Instrument

The study utilized a researcher-made questionnaire validated by a pool of experts. The questionnaire focuses on assessing the Development Thrust and Policy Support by the Local Government of Butuan towards Land Use Conversion, Rice Production Food Security in Butuan City. Before the questionnaire was used, it was pre-tested to a group of farmers in Butuan City who were not part of the subject of the study. The questions

and observations of the farmers were recorded and considered by the researcher.

Statistical Treatment

The data collected were analyzed and interpreted with the use of the arithmetic mean and Pearson correlation.

RESULTS AND DICUSSION

Table 1. Rate of Rice Field Conversion

Rice Barangays	**Palay Areas(has)**	**Converted Areas(has)**	**Rate of Conversion**
1. Ambago	37.5	6.8766	18.33%
2.Bancasi	105	4.9958	4.75%
3.Banza	110	4.5640	4.14%
4. Bonbon	119	55.9115	46.98%
5.Dumalagan	101.05	2.00	1.97%
6. Kinamlutan	399.50	5.9440	1.48%
7.San Vicente	119	3.9152	3.29%
8.Tiniwisan	260.10	0.7206	.27%
9.Tungao	13	0.2524	1.94%
10. Villa Kanangga	56.50	3.85090	6.81%
GRAND TOTAL	**1,320.65**	**89.031**	**89.96**

Sources: City Agriculturist Office, DARO, 2017)

Table 1 shows that Barangay Bonbon has the biggest area converted into non-agricultural use. It has hilly topography, which makes the land difficult to till and cultivate. Farmers changed the use of their lands as it is more economically feasible for residential and recreational areas. The short distance of Barangay Bonbon to the central part of the city makes the place very ideal for housing and recreational usages such as resort and other outdoor activities.

The study of Wasilewski & Krukowski (2004) supports the findings that the low profitability of agricultural production compared to the lucrative price of recreation and housing plots encourage the farmers to sell or convert their farms. Thereby, the Local Government Unit relented and approved land conversion, leading to a significant increase in revenue.

Whereas barangay Tiniwisan shows the least rate of conversion of 0.7206 hectares. The 260.10 hectares of rice field is located at the outskirt of Butuan City. It is seven kilometers away from the proper city area. Most people rely on agriculture, such as rice production (WBQR, 2009). This implies that rice farmers can be motivated by the

Local Government Unit to continue rice farming by continually improving their plans, programs, and projects for rice farming activities in the city.

Table 2. Mean Distribution of Respondents' Perception on Developmental Thrusts

Developmental Thrusts	LGU		Farmers/ Landowners		Overall	
	Mean		Mean		Mean	Description
1. There are existing irrigation facilities in the rice fields in Butuan City	3.83	VG	3.19	G	3.51	G
2. The irrigation facilities are functioning well	3.29	G	3.21	G	3.25	G
3. There are technology trainings for farmers or cooperatives to improve their farming practice and business	3.71	VG	2.42	F	3.065	G
4. Conducted trainings for modern farming such as planting high breed rice	3.79	VG	2.06	F	2.92	G
5. Farmers are provided with Seed Subsidy for high breed rice	3.58	VG	1.65	F	2.61	G
6. Farmers are provided with farm inputs subsidy such as fertilizers	3.58	VG	2.21	F	2.89	G
7. Farmers are provided trainings on how to use farm waste as organic fertilizers	3.75	VG	2.87	F	3.31	G
8. Pre-harvest and Post-Harvest Facilities are provided (rice mills, solar dryers/mechanical dryers, shellers, thresher, power tillers)	3.88	VG	3.17	G	3.52	G
9. Farmers are provided with technical assistance/repair of post-harvest technology	3.33	G	2.19	F	2.76	G
10. There is an existing LGU initiated rice support program which is farmers' friendly	3.25	G	2.19	F	2.72	G
11. The LGU initiated program or services are very convincing to make farmers stay in farming rather than selling or converting their lands	3.38	G	2.50	G	2.94	G
12. There is sufficient number of extension workers to provide extension services and technical assistance to rice farmers.	3.13	G	1.73	F	2.43	F
Overall Mean	3.54	VG	2.44	F	2.99	G

Scale: 1 - Poor (P) 3 - Good (G) 5 - Excellent (E)
2 - Fair (F) 4 - Very Good (VG)

Table 2 shows the data on the Development Thrust of Butuan City in relation to land-use conversion. The LGU respondents obtain an overall mean rating of 3.54 which means very good, while farmer respondents obtain a mean rating of 2.44 which means

fair. The unparalleled perception of both respondents in the Development Thrust of the LGU signifies different views. The LGU respondents as the service providers perceived that they had given sufficient preferential attention to irrigation facilities, technology training on modern rice farming, provision of seed subsidy, fertilizer subsidies, and pre- to post-harvest facilities. These are the indicators that fall on the development thrust of the Local Government Unit.

However, the farmer respondent's perceptions rated the Local Government Unit Development Thrust as merely fair. Farmers as the program beneficiaries perceived that they are not satisfied with the Local Government Unit Development Thrust relative to land conversion because of 8 out of 12 indicators, farmer respondents rated them as fair, especially on the item of technology training, modern farming training, provision of seed subsidy, fertilizers, training on organic fertilizer, Local Government Unit initiated the program and the number of extension workers that serve the farmers.

The farming communities in Agusan del Norte stated that farmers need the functional irrigation system, fertilizers, pre-and post-harvest facilities, training on pest control, and organic farming technology.

This implies that if a provision of quality and excellent services on the Local Government Unit Development Thrust is provided, farmers tend to preserve their farmlands rather than sell or convert them. This would ensure food security in the city. However, the findings manifested the farmers' dissatisfaction towards LGU Development Thrust. Local Government Unit Butuan City should focus more on these factors and make doable efforts so that farmers will be convinced of preserving their land for agricultural use.

Table 3. Mean Distribution of Respondents' Perception on Policy Support

Policy Support	LGU		Farmers/ Landowners		Overall	
	Mean		Mean		Mean	
1. There is a clear policy or ordinance of Land Use Classification in Butuan City	3.46	G	2.13	F	2.80	G
2. The policy/ordinance on Land Use Classification is easy to comply	3.46	G	2.10	F	2.78	G
3. The LGU has a strict implementation of Land Use Conversion in Butuan City	3.29	G	2.37	F	2.83	G
4. The identified productive rice fields are protected from Land Use Conversion	3.25	G	2.19	F	2.72	G
5. The LGU conducts constant monitoring of palay harvest in Butuan City	3.58	VG	2.79	G	3.19	G

6. The LGU conducts constant monitoring of rice stocks of Grains Businessmen	3.46	G	2.81	G	3.13	G
7. The observed rice field conversion follows the strict process from the LGU	3.25	G	2.12	F	2.68	G
8. Irrigated rice fields are strictly prohibited for non-agricultural land use conversion	3.38	G	2.10	F	2.74	G
9. Fair implementation of the law in rice field conversion is properly observed & followed.	3.42	G	2.40	F	2.93	G
10. The LGU of Butuan City protects the sustainability and stability of rice fields for food security.	3.67	VG	2.19	F	2.93	G
Overall Mean	**3.42**	**G**	**2.32**	**F**	**2.87**	**G**

Scale: 1 - Poor (P) 3 - Good (G) 5 - Excellent (E)
2 - Fair (F) 4 - Very Good (VG)

Table 3 shows the data on the policy support for land use conversion of Butuan City that supports rice production and food security. The Local Government Unit respondents have a mean rating of 3.42 which means good, while the farmer respondents have 2.32, which means fair.

The Local Government Unit perceived that the policy support on land-use conversion is good, but the farmers and landowners responded that the provisions are limited in terms of implementation and their functions are minimal when it comes to; clarity, compliance, and enactment of ordinances of land use classification, agricultural protection program, prohibition of land-use conversion on irrigated fields, and protection on the sustainability and stability of rice fields for food security.

The farmer respondents rated the LGU policy support as merely fair. Farmers are directly affected by the Land Use Conversion. They showed dissatisfaction with the LGU Policy Implementation on Land Use Conversion because of 8 out of 10 indicators, farmers rated them as fair, especially on the item of clarity on the procedures of the policy, enactment of the policy, agricultural protection program, strict compliance of the policy, prohibition of land conversion on irrigated areas, fair implementation of the law on conversion and protection for the sustainability and stability of rice production.

This implies that farmers need continuous support and information dissemination on the policy of land-use conversion of the LGU. Rice field owners and farmers must be subject to the strict implementation of the land conversion. The Local Government Unit of Butuan City must uphold the policy for the farmers to continue and improve their rice production, thereby ensuring food security.

Table 4. Rice Production of Ten (10) Barangays (2014-2016)

Barangays with Approved Land Use Conversion	Population PSA, 2015	Food Security Requirement (Bags)	Average Rice Production (2014-2016) (Bags)	Average Oversupply (Deficit) (2014-2016) (Bags)
1. Ambago	12,656	32,399.36	8,992.38	(23,406.98)
2. Bancasi	4,925	12,608	10,178.63	(2,429.36)
3. Banza	4,235	10,841.6	6,071.3	(4,770.3)
4. Bonbon	5,446	13,941.76	8,992.38	(4,949.38)
5. Dumalagan	2,580	6,604.8	4,446.08	(2,158.72)
6. Kinamlutan	3,097	7,928.32	36,711.24	28,782.92
7. San Vicente	16,187	41,438.72	15,483.56	(25,955.16)
8. Tiniwisan	3,684	9,431.04	17,176.72	(155.93)
9. Tungao	5,702	14,597.12	681.46	(13,915.66)
10. Villa Kanangga	11,173	28,602.88	2,234.7	(26,368.18)

Sources: Butuan City Agriculturist Office, PSA

Table 4 shows that only barangay Kinamlutan has a consistent overproduction of rice among the ten barangays with approved land-use conversion. The rice production from 2014 to 2016 showed no deficit in rice production; instead, it has more than four times overproduction from the required food security in Butuan City. The rest of the barangays have massive disparity or deficit from the rice production, such as barangay Villa Kanangga which showed the highest average deficit of 26,368.18 bags from 2014 to 2016 rice production. The conservative computations are based on the study that in the Caraga Region, one person consumes 128 kilograms or 2.56 bags of rice each year (IRRI, 2009).

For further elucidation, a sample calculation of Barangay Ambago is cited. It is densely populated by 12,656 people (PSA, 2015), which requires 32,399.36 bags annually, but the rice production in 2014 was only 8,127.40. This indicates that 24,271.96 bags of rice were sourced out from other barangays or nearby municipalities and provinces. The deficit of rice productions in nine barangays is mostly descending in manner.

Some barangays which have an overproduction of rice, such as Kinamlutan, help fill in the deficit incurred by the rest of the barangays in Butuan City. But the overproduction filler from a few barangays is not enough to balance the supply and demand of rice as a staple food in Butuan City.

This implies that further deficit in rice production may continue to aggravate in these barangays when agricultural lands such as rice fields are continued converted to non-agricultural uses.

Table 5. Rice Production (2014-2016) in correlation to Land Use Conversion

Rice Production (2014-2016)	Hectarage of Rice			Converted Rice Fields		
	r	p	Results	r	p	Results
First Cropping	.952	.000	significant	-.022	.952	Not significant
Second Cropping	.937	.000	significant	-.027	.941	Not significant
Annual Harvest	.956	.000	significant	-.025	.944	Not significant

Source: City Agriculturist Office, DAR, 2017

Table 5 indicates an apparent significant relationship between rice harvest and the land area of rice fields because it is a known fact among farmers that one of the primary reasons for higher yield is the bigger land area followed by the variety or breed of rice and irrigation system. In addition, palay production in 2013 averaged 3,960 kilograms per hectare in irrigated farms and 2,692 kilograms per hectare in non-irrigated farms (PSA, 2013).

On the other hand, when it comes to the relationship between land-use conversion and rice production of 10 barangays with approved land conversion, it is deemed insignificant because the percentage of land use conversion in these ten barangays is only 6.81 percent, as shown in Table 4.

This implies that the approved land used conversion is inconsequential from the rice production from 2014-2016. However, it is probable that in the coming years, as the land-use conversion to non-agricultural uses increases, it would affect the rice production in Butuan City as the conversion decreases the rice fields.

Table 6. Rice Stocks in correlation to Land Use Conversion

	Pearson r	p	Results	Decision
NFA Stocks	-.887	0.002	Significant	Reject null
Commercial Stocks	.260	0.057	Not Significant	Accept null
Household Stocks	.097	0.556	Not Significant	Accept null

Source: National Food Authority, 2017

Table 6 shows that National Food Authority stocks are directly affected by the land-use conversion. The National Food Authority buys from farmers and farmers' organizations at the government support price of Php17.00 per kilogram of dry palay. This is to prevent grains businessmen from lowering the farmgate price and enabling farmers a fair return on production investment. This program is undertaken to ensure and establish manageable buffer stock in line with the agency's function of stabilizing consumer price levels and assuring an adequate and continuous rice supply. This involves actual procurement from individual and organized small farmers, but local farmers do not sell their produce to National Food Authority because of the lower buying price.

They chose to sell their produce to other businessmen and merchants, which offer them a higher price. Some farmers sell their produce to businessmen who have given them financial assistance from crop planting.

On the other hand, this data indicates that Commercial Stock has no significant relationship towards land-use conversion, but this is only the top of an iceberg situation because traders brought the volume of commercial stocks and grains businessmen from nearby municipalities, cities, and even regions as well to augment their supplies (NFA, 2017). The household stocks show no significant relationship towards land-use conversion for it is directly sourced in from the commercial stocks. The Philippine Statistics Authority randomly does household stocks surveys to different levels of household in terms of income and buying capacity.

In 2016, the local procurement of National Food Authority Butuan City constituted less than 1 percent of their buffer stocks stored in the warehouses.

This implies that continues approval of land use conversion will greatly affect the food security program of the National Food Authority as it continuously decreases the rice production of farmers.

CONCLUSIONS

Based on the findings, the following are the conclusions drawn;

1. **Land Use Classification.** Findings revealed that the majority of land use classification of Butuan City goes to the agricultural production area, which is 52.08 percent, followed by forest area, 32.79 percent, existing areas by spatial distribution such floodwalls, dumpsites made up to 6.49 percent from the total land area of Butuan City.
2. **Rate of Conversion.** Land use conversion has a noticeable impact on rice production and food security in Butuan City because the rice production does not meet the food security requirement of the population in Butuan City. Among the ten barangays with approved land-use conversion, only one has no deficit in rice production from 2014-2016. The rest of the barangays have a massive deficit from their rice production. Moreover, the rapid urbanization of Butuan City demands more expansion for commercial, industrial, and residential areas which directly affect farmers' output. The land use reclassification applications submitted to the Office of the City Planning and Development Coordinator have reached 442 hectares. A doable Agricultural Land Protection Program ensures higher production and food security in Butuan City.
3. **Status of Rice Production.** The status of rice production from the ten barangays which have approved land-use conversion is significantly affected by the land-use conversion. Among the ten barangays, only Barangay Kinamlutan showed average overproduction of 28 782.92 bags of rice from 2014 to 2016. The rest of the barangays have massive disparity or deficit from the rice production, such

as barangay Villa Kanangga which showed the highest average deficit of rice production from 2014 to 2016.

4. **Level of Food Security**. The level of food security when it comes to commercial and household stocks is relatively above the food security requirement of Butuan City, while the buffer stocks of the National Food Authority were below the food security requirement from 2016 to 2017. The

RECOMMENDATIONS

The following recommendations are based on the findings of the study.

1. The Local Government of Butuan City should review the City Zoning or land use plan and adapt Agricultural Land Protection Program that would ensure farmers' productivity and food security in the city.
2. Farmers need to be further educated to keep updated on fast-moving developments in rice farming technology, science, business management, and other skills that affect agricultural operations. Rice farmers need to apply scientific knowledge to enhance stewardship of the ecosystems. They also need to be trained in using new tools and technologies to improve operations and increase profit.
   This program shall be in partnership with the Department of Agriculture -Agriculture Training Institute (ATI-Butuan City) and International Rice Research Institute Agusan del Norte to ensure the transfer and acquisition of knowledge through their Accredited Competency Assessment Centers.
3. Policies relating to agricultural development may be encouraged to cultivate remaining agricultural lands and the re-cultivation of neglected agricultural lands. To cultivate the productivity of remaining agricultural lands while maintaining an environment for urban dwellers, irrigation and sanitation must also be improved at the city planning level. Urban land utilization is also necessary to assist a developing economy, but urban development should be promoted in landscape units since these units are already vulnerable to land-use conversion. In this way, contiguous agricultural areas will be continuously preserved with their sustainable functions. The isolated open areas which can no longer sustain agriculture can also be developed as recreational parks within high-density urban developments to provide a healthier environment.

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