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DEGREE OF FARMING INNOVATIONS AND THE LEVEL OF PRODUCTIVITY OF SUGARCANE FARMERS IN THE VISAYAS, PHILIPPINES

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Abstract:

Farming innovations employed by sugarcane farmers is usually done by integrating the sugarcane production technologies. The main purpose is to increase productivity and sustainability of the sugarcane industry (Priyanka, et. Al. 2019)

This descriptive method of research aid at determining the degree of farming innovations employed and the productivity of sugarcane farmers in the Visayas, Philippines. The 400 sugarcane farmers randomly identified at the 10 Mill Districts in the Visayas area of the Philippines. An instrument used was the agency Extension Program Guidelines that measures productivity of the farmers and degree of innovations employed by farmers, among others.

The result shows that the level of productivity of sugarcane farms in the Visayas area was high and a significant difference indicates on the level of productivity of sugarcane farms when grouped as to location. The level of productivity of sugarcane farming in the Visayas in terms of indicators such as size of farm, type of soil, land topography, average rainfall received, distance of the farm to the sugar mill, farming innovations, workers' availability and expenses per hectare was at low productivity. Significant difference in the productivity of sugarcane farming in the different Mill Districts in the Visayas area in terms of size of farm, land topography, distance of the farm to the sugar mill, farming innovations, workers' availability, and expenses per hectare except for the type of soil and average rainfall. The degree of innovations employed by farmers does not significantly related to the productivity. Farmer's innovations does not influence the level of productivity.

Keywords: Farmers Innovation, Level of Productivity, Sugarcane Farmers

INTRODUCTION

1.1 background

Farming innovations employed by sugarcane farmers is usually done by integrating the sugarcane production technologies. The main purpose is to increase productivity and sustainability of the sugarcane industry (Priyanka, et. Al. 2019).

Like any other ASEAN countries, the Philippines is not so prepared until now by the impact of 2015. The industry should now be through with the identification of the things to be done. The Philippines must therefore be on the implementation phase of appropriate programs and interventions to enable the industry to address the threats and exploits the opportunities of trade liberalization, especially on the delivery of modern agricultural extension services.

For sure, the country will be greatly affected by the reduction of tariff of imported sugar at 5% (starting 2015). The full integration of ASEAN Economic Community (AEC) wherein the goods and services (including sugar) is expected to flow freely within the Region, the Philippine sugarcane industry will need to gear up for competition against its neighbors in the AEC.

The Sugarcane Roadmap 2020 (CY 2014-15 to CY 2019-20 version, September 2015) of the government, mentioned that the industry had increased its contribution to the national economy to as much as Php87 billion in Crop Year 2013-14 from Php76 billion only in Crop Year 2009-10 (The Sugarcane Industry Roadmap 2010, CY 2010-11 to 2015-16 version).

The increase was from sales of raw sugar, molasses, and bioethanol, tolling fees on sugar refining and VAT on refined sugar. In addition, it brought in US$ 111.76 million in CY 2013-14 through exports of sugar to the US and world

markets. Moreover, the displacement of gasoline with 10% derived from sugarcane and molasses, it also generates savings of foreign currency reserves apart from contributing towards a cleaner and greener environment.

Under the current scenario it was spelled out on the roadmap, the more productive and competitive sugarcane industry will further increase its contribution to about Php100 billion through the opening of additional bio-ethanol plants and production of renewable power as well as other products from sugarcane like specialty sugars, bio-water, bio-plastics and more. The establishment of support industries will likewise contribute significantly to the revenue streams on an expanded sugarcane industry.

At present, sugar statistics shows that there are more than 80,000 farmers who are tilling the 424,199 hectares (out of the total land area of 30 million hectares, (SRA Bulletin, March 04, 2018) of sugarcane fields all over the country with an average production of 59 tons per hectare and LKg/TC of 1.98 (CY 2016-17). Of the total number of sugarcane farmers mentioned-above majority of them are considered small (farms are 5 hectares or below). In Crop Year 2015-16: 79% are small farmers, 17% are cultivating 5.01 to 50.00 hectares and only 4% have 50.01 hectares and above (Overview of the Sugarcane Industry, updated October 2017).

The total number of agricultural and industrial workers who are directly employed in the industry is about 700,000. Furthermore, under the industry are 27 operating sugar mills, 13 operating sugar refineries, 10 operating bio-ethanol fuel distilleries and 6 biomass power-generating plants as of Crop Year 2015-16 (Executive Summary, DRRM Plan for the Sugarcane Industry 2017-2022).

Relatively, latest survey mentioned by Crisostomo (2018), indicates that sugarcane farms have a total of 32,000 laborers second to the banana plantation with 49,866 workers. An estimated 700,000 "sacadas" (seasonal plantation workers) is working in sugar and other haciendas (estates) nationwide, it mentioned further.

Talking about mill district, a "Mill District" refers to a centrifugal (raw) sugar mill together with the sugarcane plantations adherent thereto. A plantation is deemed adherent by virtue of sugarcane being delivered to a mill regardless of contract relation between the mill and the plantation owner and/or any other person cultivating sugarcane in the plantation contiguous to the mill (as defined on the Implementing Rules and Regulations of RA 6982).

On the production side, the total volume of sugar which was produced by the fourteen (14) mill district in the Visayas was 1.65 million metric tons which is 66.00 percent of the total production of the country (2.50 million metric ton) for Crop Year 2016-17 (Extension Services-Visayas, 2018).

Domestic production of raw sugar for Crop Year 2015-16 had failed to 2.27 million metric tons as compared to the previous Crop Year 2016-17 with a total production of 2.50 million metric tons (the highest after 34 years). The decrease in the production was due mainly to "La Niña" (heavy rainfall) and the erratic weather condition (Ocampo, 2018).

Sa-onoy (2014) cited that mentioning the increase on productivity and improving of farm and mill efficiency is a sad fact. According to him, these are the pipe dream that had been the battle cry of the industry leaders, but they eluded the industry for years.

We have no new mill; the existing mills are already inefficient, and land devoted to sugarcane has been steadily declining since the passage of the Comprehensive Agrarian Reform law the expanding demand for living and business space. He further explained that in the year 1977, we produced three million tons of sugar but today we produced half a million or less. In that year, Negros had 15 sugar mills with 260,925 hectares of land planted with sugarcane.

Sa-onoy commented further that despite of the herculean efforts of the extension workers in extending and introducing to the farmers the modern technologies but still the targeted increase in the production could be hardly realize. There are so many factors that attributes to this.

Climatic factors that influence sugar yields are rainfall precipitation (greatly affects soil moisture), temperature range, light intensity, and duration, photoperiod and occurrence of typhoons or long drought. Likewise, for edaphic or soil factors are soil type, pH, and organic matter content Cerbo (2009).

Alulod and Cerbo (2009) concluded on their paper that the total area planted to varieties performing lower and higher than the mill districts average sugar per hectare (LKg/ha) production in Negros-Panay Islands for Crop Year 2004-05 was 86,251.25 and 137,705.46 hectares, respectively. They recommended that the agency and farmers association should rapidly propagate the new HYVs to replace those varieties not suited in a certain locality so that an increase in productivity per unit.

After a minimum profit levels are attain, other objectives can be pursue. The bottom line is that market-oriented farming requires a business approach to survive. The challenge face by the farmers in times of competition is how to increase profitability. Profit is important for commercial farming.

Girei and Giroh (2012), had mentioned on their study that in order to demand to the company in terms of high-quality cane supply and to generate sufficient funds for the out grower (accommodated) farmers, the issue on low cane yield should be addressed through provision of high yielding varieties (HYV), disease resistant, productive and pest/disease free farms.

Sulaiman and his company (2015) had recommended that to boost production and demand for the crop; there is a need for supplying of improved variety of the sugarcane sett (canepoints).

To keep the sugarcane industry sustainable, the government must eliminate the tariff on inputs to reduce the costs of production such as fertilizers regarding lower prices. The reason why the local sugar industry is in the state of disarray is that local sugar is price higher than imported sugar. This is due to the high cost of inputs. Lowering the

domestic costs of production would make the price of local sugar competitive in the world market, this was the conclusion on the study conducted by Doloriel last 2014.

She further concluded that sugarcane farming is productive and profitable only for medium and large sized farms with the areas ranging from 10.01 hectares and above. This means that small sugarcane farming is not profitable.

Doloriel had further observed that first ratoon cropping in sugarcane production is the most productive and profitable. The Philippines Recommends for Sugarcane technically explained that first ratoon crops was consider as secondary tillers. Earlier flushes of tiller competition were desirable because it gave more uniform plants resulting to less tiller competition. Besides, secondary tillers were closer to the soil. Therefore, the roots could penetrate deeper to the soil and could absorb more nutrients compared to those of the preceding ratoons.

Talking of income and size of area planted, the result of the study of Kumar and his company in India (2014) shows that small farm seems to be less efficient than large and medium farms. Hence, gross returns and cost of production of sugarcane (ratoon) crop showed direct relationship with the size of the farms. It was observe that total cost of production and gross returns both increases as the size of farm increase.

It was on that contention that the researcher had developed the purpose of the study, improved the productivity and assessed the extension services rendered by the government to farmers-client at the different Mill Districts in the Visayan area of the Philippines for the coming crop years.

1.2 objectives

1.2.1 The general objective of the study is to determine the importance of the extent services in increasing the productivity of small farmers.

1.2.2 Specific objectives

1.2.2.a Extent of services to sugarcane farmers and level of productivity

1.2.2.b Extent of services to sugarcane farmers and farm profile

1.2.1.c. The productivity of sugarcane farmers in a specific location

1.2.1.d. Factors affecting the productivity of sugarcane farmers

1.2.1.e. The productivity and farm profile

1.3 statement of the problem

Sugarcane industry is one of the major dollar income industry in the Philippines. The productivity however and profitable only for medium and large sized farms with an areas of 10.01 hectares and above. This means that small sugarcane areas is not profitable which is 79% of the total national area of 424,199 hectares. This study aims to improve the level of productivity of sugarcane farmers and farm profile in the Visayas, Philippines

2.MATERIALS AND METHODS

2.1 Research Method

The descriptive correlational study was use in this study. It focuses in measuring the extent of services to sugarcane farmer's areas and level of productivity among others, to the different Mill Districts in the Visayan area of the Philippines.

2.2 Research Environment

The study was conducted at the 10 Mill Districts in the Visayas area. The Visayas area was composed of six provinces namely: Negros Occidental, Negros Oriental, Capiz, Iloilo, and Leyte.

Specifically the study covered the following Mill Districts, namely: San Carlos and Victorias for northern portion of Negros Occidental; La Carlota-Ma-ao and BISCOM for southern portion of Negros Occidental; Tolong and Bais-URSUMCo for Negros Oriental; Iloilo and Capiz for Island of Panay; Bogo-Medellin/Durano for Island of Cebu; and, for Island of Leyte its Ormoc-HIDECO Mill District.

2.3 Respondents

The respondents of the study were the sugarcane farmers at the Visayan area with 10 hectares and below.

Employing the *Slovins* formula, out of 29,151 sugarcane farmers from the 10 Mill Districts mentioned-above, the sample size of 400 farmers were randomly selected as the actual respondents of the study. The distribution of the respondents and the sample per Mill District is indicated on Table 1.

Table 1. Distribution of Respondents per Mill District

Location (mill district)	Number of farmers	Percentage
ILO - Iloilo Mill District	60	15.00
CAP - Capiz Mill District	30	8.00
BOG - Bogo-Medellin/Durano MD	20	5.00
ORM - Ormoc-HIDECO MD	20	5.00
TOL - Tolong Mill District	50	13.00
BAS - Bais-URSUMCO MD	70	18.00
BIS - BISCOM Mill District	55	14.00
LAC - La Carlota/Ma-ao MD	35	8.00
VIC - Victorias Mill District	35	8.00
SAC - San Carlos Mill District	25	6.00
Total	**400**	**100.00**

2.4 Research Instrument

The instrument used to gather data was the agency Extension Program Guidelines with eight parts. It include the measurement for the extent of services to farmers the farm profile and productivity among others.

2.5 Data Gathering Procedure

The researcher had personally administered the questionnaire to the respondents with the assistance of government Technical Personnel/Junior Agriculturist at the different Mill Districts in the Visayas. Upon retrieval of the accomplished research questionnaire, the researcher had tallied and analyzed the data using the Statistical Package for Social Sciences (SPSS) software under the closed supervision and guidance of the statistician.

2.6 Statistical Tool

In the analysis of data, the following statistical tools that were used in accordance with the nature of the specific problems raise and their corresponding hypotheses.

Frequency and percentage was use to describe the extent of services, profile of the sugarcane farmers' and of the farms.

The mean was used to determine the level of productivity. The mean was solved using the following procedures, the highest and lowest rating was determined first.

Then lowest score of one (1) was deducted from the highest rate of 5. The subtrahend was divided by five (5) which was adapted from Likert's rating. The addition of quotient started from the lowest rate and ended at highest rate. The numeral ranges and corresponding verbal description, 5.00 being the highest interpreted as "Very High" and 1.00 being the lowest interpreted as "Very Low".

One way Analysis of Variance (ANOVA) were used to determine the difference in the level of productivity, when respondents were grouped according to location of farm, average size of land holding, type of soil planted to sugarcane, topography of the area, average rainfall received and distance of farm to sugar mill.

Pearson r Moment Correlation was utilize to determine the significant relationship between the level of productivity, sugarcane farmers and farm profile.

3.RESULTS AND DISCUSSIONS

Profile of farmers

Table 2 revealed the farmers profile at the different Mill Districts in the Visayas in terms of gender, age, level of education and number of years in sugarcane farming, Crop Year 2016-2017.

The findings reveal that out of 400 farmers involved in the study, there were more male (f=229, 57%) than the female (f=171, 43%) as shown on Table 3.

Furthermore, the findings show that the majority of the farmers were either medium aged or old 36-60 years old (f=204, 51%), young farmers aged 35 years old and below (f=41, 10%) and those aged 61 years old and above labelled as old (f=155, 38%).

As to the educational attainment, majority of the farmers were high school level (f=225, 56%) and the least had the vocational attainment (f=2, .5%).

For the number of years in sugarcane farming, most of the farmers were considered as medium for 11 to 20 years (f=173, 43%), and few belonged to old as 20 years and above (f=93, 23%).

The findings on Table 3, implies that the farmers at the different mill districts in the Visayan area were majority male, aged 36-60 years old, high school level and have been in sugarcane farming for 11 to 20 years.

In connection with this finding, a study of Gallen (2015) which is using Danish matched employer-employee data, the paper estimates the relative productivity of men and women and finds that gender "productivity gap" is 8 percent implying that just under two thirds of the residual wage gap can be accounted for by productivity differences between men and women. The productivity gap was measured by estimating the efficiency units lost in a firm-level production function if a worker is female, holding other explanatory covariates such as age, education, experience, occupation, and hours worked constant. Furthermore, both mothers and non-mothers are paid less than men, but the (low) relative pay of mothers is completely explained by productivity for women without children.

Table 2. The Socio Distribution of the Farmers

Variables	Number of Farmers	Percentage
Gender		
Male	229	57.00
Female	171	43.00
Age		
Young (35 yrs old and below)	41	10.25
Medium (36 - 60 years old)	204	51.00
Old (61 yrs old and above)	155	38.75
Level of Education		
Elementary	87	21.75
High School	225	56.25
College	86	21.50
Vocational	2	00.50

Number of Years in Sugarcane Industry		
New (10 yrs and below)	134	33.50
Medium (11 - 20 years)	173	43.25
Old (21 yrs and above)	93	23.25
Total	**400**	**100.00**

Cultural and milling management and the degree of innovations employed by sugarcane farmers at the different locations in the Visayas

The data in table 3 shows mean analysis of the cultural/milling management and the degree of innovations employed by sugarcane farmers at the different Mill Districts in the Visayas was "moderately innovative" (M=2.66). This means that innovations employed by sugarcane farmers at the different Mill Districts in the Visayas was at average or still in the process of improving their method of farming.

Specifically, the respondents have "moderately innovate" their management on land preparation (M=2.72). Planting (M=2.58), soil rehabilitation (M=2.50), basis of fertilization (M=3.18), frequency of fertilization (M=2.63), and correct placement of fertilizers (M= 2.44). Furthermore, weed control (M=2.75), cultivation (M=2.49), construction of drainage (M=3.16), controlling disease (M=2,54), harvesting (M=3.02), disposal of trash (M=2.98), volume of cade delivered to mill (M=3.05) and trash deduction (M=3.36).

Need to be improve further by the respondents with "less innovation" rating are on the following cultural/milling management. Planting density or number of cane points per unit area (M=2.14), variety use (M=2.08), irrigation (M=2.30), controlling of pest (M=2.12), ratooning (M=2.17) and duration of delivery of harvested cane to the sugar mill.

The findings of the study implied that the sugarcane farmers are moderately innovative at the different mill districts in the Visayas.

Sulaiman and his company (2015) had recommended that to boost production and demand for crop, there's a need for supplying of improved variety of the sugarcane sett (canepoints). On sugarcane, studies showed that use of high-yielding varieties give an average increase of 12 bags per hectare as One-Drive compared to planting of an ordinary (old) sugarcane variety, as cited by Landoy and Tapay (2009).

One of the most economical approaches towards increasing the yield per unit area is the planting of high yielding and diseases resistant varieties according to Bombio, 2009 and Velasco *et al.,* 2017.

An increased of five percent (5%) in tonnage and seven percent (7%) in sugar production (LKg) was obtained when organic humus was added on top with the recommended rate of fertilizers. This was the result of farm demo conducted by Oñal (2006) in Bago City, Negros Occidental. Non-drying of cane leaves during long dry spills and plant vigourity was noted for the treated one. The demo aims to reduce cost of production and use of materials that are environmentally friendly, yet it can increase the farm productivity.

Around fifty percent (50%) of agricultural cost (direct cost) in sugarcane farming is being spend on fertilizers inputs. Thus, agency extension workers usually recommend for the gathering of soil samples for laboratory analysis that will be a guide to the farmers on their fertilizers management.

On liming, the study conducted by the group of Guevara (2013) on the effect of calcitic lime on the cane and sugar of three varieties for five years shows that increasing the quantity of lime up to 6 tons per hectare gave a corresponding increase in production, which ranges from 2 to 6 tons per hectare.

In contrast to drought, excess water during irrigation or heavy rain should be drain out. Cotching (2018) said that based on his experience in advising farmers on drainage systems over many years, farmers can achieve at least a 20% increase in crop growth and utilization if good drainage is install. His key observation is that reducing water logging can significantly boost the production.

Sugarcane crop are vigorous and produce a number of crops before changing it to new plant, it can be ratoon up to 30 times for variety NCo376 in Swaziland

In Australia, where chopper harvesters were first used systems of transport were developed to keep the transport delay down to less than 16 hours. Above that time, dextran formation occurred to the extent that the processing of cane was impaired. In Brazil it is considered that 16 hours delay is unacceptable because the cane deterioration is very fast under climatic conditions. The normal average delay for chopper harvester cane, when using trucks for cane transport, is five hours (E. Marino pers. Comm., 2011).

Table 3. Mean result for degree of innovations employed by farmers in the different locations in the Visayas

Cultural and Milling Management Indicators	Mean for Degree of Innovations			Total Mean	Description
	Innovative	Semi-innovative	Traditional		
1. Land preparation	1.44	2.67	4.06	2.72	Moderately innovative
2. Planting	1.43	2.55	3.76	2.58	Moderately innovative
3. Planting density	1.68	1.67	3.06	2.14	Less innovative
4. Variety use	3.04	1.39	1.81	2.08	Less innovative
5. Soil rehabilitation	3.97	1.36	2.17	2.50	Moderately innovative
6. Fertilization (basis)	3.80	3.37	2.36	3.18	Moderately innovative
7. Fertilization (frequency)	3.86	1.73	2.29	2.63	Moderately innovative
8. Fertilization (placement)	2.59	1.72	3.02	2.44	Moderately innovative
9. Weed control	2.74	2.90	2.62	2.75	Moderately innovative
10. Cultivation	2.50	2.06	2.90	2.49	Moderately innovative
11. Irrigation	3.14	1.95	1.81	2.30	Less innovative
12. Drainage	3.43	2.90	3.16	3.16	Moderately innovative
13. Pest control	2.07	1.89	2.39	2.12	Less innovative
14. Disease control	3.44	3.22	2.54	3.07	Moderately innovative
15. Harvesting	3.16	3.14	2.75	3.02	Moderately innovative
16. Ratooning	2.75	1.95	1.81	2.17	Less innovative
17. Trash disposal	2.60	3.43	2.90	2.98	Moderately innovative
18. Cane delivery	3.16	2.07	1.89	2.37	Less innovative
19. Cane volume	2.39	3.44	3.32	3.05	Moderately innovative
20. Trash deductions	3.32	3.44	3.32	3.36	Moderately innovative
Total Mean	**2.83**	**2.44**	**2.70**	**2.66**	**Moderately Innovative**

Level of productivity of the sugarcane farms in the Visayas in terms of tonnage when grouped according to degree of farming innovations

Table 4 shows the level of productivity of sugarcane farms in the Visayas using the mean. The results revealed that in general, the level of productivity of sugarcane farms in the Visayas when grouped to the degree of farming innovations (M=2.11) was at "Low".

The degree of farming innovations were categorize into three, namely: innovative, semi-innovative and, the traditional one. Innovative farming is classified when farmers had use 100% of the technologies recommended. Semi-innovative farming on the other hand is when the farmers is still trying to adopt the recommended technologies from his usual way of farming. Traditional farming is that when the farmers does employed any recommended technology.

The integration of innovations like the system diversification, reducing cost including the increased of processing plant system had ensured increase of production (Priyanka, et. Al. 2019).

Table 4. Mean result on the productivity of sugarcane farms in the Visayas when grouped according to degree of farming innovations

Degree of farming innovations	Mean	Description
Innovative	2.26	Low
Semi-innovative	2.13	Low
Traditional	1.96	Low
Total	**2.11**	**Low**

Difference on the Level of productivity of the sugarcane farms in different locations in the Visayas when grouped by innovations employed by the farmers

The data in Table 5 presents the difference in the level of productivity of sugarcane farms in different locations in the Visayas when grouped by innovations employed by the farmers. It further revealed that there is a significant difference in the level of productivity of sugarcane farms in the Visayas when grouped by innovations employed by the farmers (F=12.194, sig. at .000). The results implied that there is a significant difference between productivity and the degree of innovation employed by the farmers.

This means that the level of productivity of sugarcane farms in the Visayas when grouped by location are not comparable.

Table 5. Difference on the Level of Productivity of the sugarcane farms in the Visayas when grouped by innovations employed by the farmers

Location	Mean	F	Sig.	Decision
Mill Districts	**1.35**	12.194	0.000	Reject H_o
1. Iloilo	2.13			
2. Capiz	1.00			
3. Bogo-Medellin	1.00			
4. Ormoc-HIDECo	1.15			
5. Tolong	1.36			
6. Bais-URSUMCo	1.64			
7. BISCOM	1.00			
8. La Carlota/Ma-ao	1.00			
9. Victorias	1.00			
10. San Carlos	1.00			

Level of productivity on sugarcane farming of the different Mill Districts in the Visayas in terms of indicators

Table 6 shows the level of productivity of sugarcane farming in the different Mill Districts in the Visayas in terms of indicators such as size of farm, type of soil, land topography, average rainfall received, distance of the farm to the sugar mill, farming innovations, workers' availability and expenses per hectare using the mean. It further revealed that the level of productivity of sugarcane farming in the different Mill Districts in the Visayas (M=1.98) was at "low productivity". This means that the productivity of sugarcane farming in the different Mill Districts in the Visayas was below average.

Specifically, the level of productivity of sugarcane farming in the different Mill Districts in the Visayas was at "low productivity" when grouped as to the size of farm (M=1.95). Type of soil (M=1.95), land topography (M=1.95), average rainfall received (M=1.95), distance of the farm to the sugar mill (M=1.95), farming innovations (M=2.11), workers' availability (M=2.01) and expenses per hectare (M=1.96).

Table 6. Mean result of the Productivity of Sugarcane Farming at the Different Mill Districts in the Visayas in terms of Indicators

Productivity Indicators	Mean	Description
Size of Farm	1.95	Low Productivity
Type of Soil	1.95	Low Productivity
Topography of the Land	1.95	Low Productivity
Average Rainfall Received	1.95	Low Productivity
Distance of the Farm to the Sugar Mill	1.95	Low Productivity
Farming Innovations	2.11	Low Productivity
Workers Availability	2.01	Low Productivity
Expenses per Hectare	1.96	Low Productivity
Total Mean	**1.98**	**Low Productivity**

Difference in the level of productivity of the sugarcane farmers (in tons/hectare) among the different mill districts when they are grouped according to indicators

Table 7 presents the difference on the level of productivity in the different mill districts in the Visayas for Crop Year 2016-2017 when they are group according to the size of farm. The type of soil, land topography, average rainfall received, distance of the farm to the sugar mill, farming innovations, workers' availability and expenses per hectare using One-way Analysis of Variance.

Results revealed that there is a significant difference in the level of productivity when grouped as to average size of the farm ($F=40.857$, $p=0.000<0.05$). The land topography ($F=7.784$, $p=0.000<0.05$), distance of the farm to the sugar mill ($F=18.293$, $p=0.000<0.05$), farming innovations ($F=12.194$, $p=0.000<0.05$), workers' availability ($F=6.921$, $p=0.000<0.05$), and expenses per hectare ($F=6.864$, $p=0.000<0.05$). Thus, the level of productivity in the different mill districts in the Visayas for Crop Year 2016-2017 when they are group according to the size of farm, land topography, distance of the farm to the sugar mill, farming innovations, workers' availability and expenses per hectare varies.

On the other hand, the results implied that there is a no significant difference in the level of productivity when grouped as to the soil type (F=0.137, p=0.999>0.05) and average rainfall received (F=1.834, p=0.061>0.05). Hence, the levels of productivity in the different mill districts in the Visayas for Crop Year 2016-2017 when they are group according to the type of soil and average rainfall received do not vary.

Table 7. ANOVA results in the Level of Productivity among the Different Mill Districts in terms of Indicators

Productivity Indicators	F	Sig	Description
Size of Farm	420.857	0.000	Reject Ho
Type of Soil	0.137	0.999	Accept Ho
Land Topography	7.748	0.000	Reject Ho
Average Rainfall Received	1.834	0.061	Accept Ho
Distance of the Farm to the Sugar Mill	18.293	0.000	Reject Ho
Farming Innovations	12.194	0.000	Reject Ho
Workers Availability	6.921	0.000	Reject Ho
Expenses per hectare	6.864	0.000	Reject Ho

Relationship between the level of productivity and farmers' innovation

The data in Table 8, showed the relationship on the level of productivity and farmers' innovation in the different Mill District of Visayas using Pearson's r. It further revealed that there was no significant relationship on the level of productivity and the farmers' innovations (r=0.122, p=0.077>0.05).

The findings implied that the level of productivity do not significantly influence the farmer innovations such as the land preparation, planting, planting density, variety, soil rehabilitation, basis, frequency and placement of fertilizers. Furthermore, it does significantly influence on weed control, cultivation, irrigation, drainage, pest and diseases control, harvesting and ratooning, trash disposal, cane delivery and volume as well as the trash deduction, among others.

In relation to findings of the study, Kaur of India (2018) had discussed on his study that in the last 15 years, agricultural production has stagnated, and this calls for a system based on inter-disciplinary holistic approach not only to develop ecologically sound technologies for different areas, but also to facilitate their utilization at grass root level.

World Bank (2021) had reported that for sugarcane the value shares had been declining on the fifteen regions in the Philippines, except for Region VI (Western Visayas) which suggests increasing the specialization for the crop. The shares in value of output of sugarcane on the three regions in the Visayas, were: 16.1%, 5.6% and 0.9% at Regions VI, VII, and VIII, respectively.

Table 8. Correlation analysis between the level of productivity and farmers' innovation

Variables Compared	Pearson r	Sig	Description	Strength of Relationship
Level of Productivity Farmers' Innovation	0.122	0.077	Accept Ho	Very Low

CONCLUSIONS

1. Most of the farmers were male, aging 36-60 years old and are high school graduate. These farmers have been in the sugarcane industry for 11-20 years.
2. Farmers in the Visayas are moderately innovative
3. The level of productivity of sugarcane farms in the Visayas was high.
4. A significant difference was note on the level of productivity of sugarcane farms in the Visayas when grouped as to location.
5. The level of productivity of sugarcane farming in the different Mill Districts in the Visayas in terms of indicators such as size of farm, type of soil, land topography, average rainfall received, distance of the farm to the sugar mill, farming innovations, workers' availability and expenses per hectare was at low productivity.
6. There is no significant difference on the productivity of sugarcane farming in the different Mill Districts in the Visayas in terms of indicators; such as type of soil, and average rainfall received. Though, there is a significant difference in the productivity of sugarcane farming in the different Mill Districts in the Visayas in terms of indicators such as size of farm, land topography, distance of the farm to the sugar mill, farming innovations, workers' availability, and expenses per hectare.
7. Farmers' innovation does not influence also the level of productivity.

RECOMMENDATIONS

1. The Department of Agriculture should look into the sugarcane productivity in the region should and assist in the needs of the farmers especially on the dissemination of modern technologies.
2. Farmers in the Visayas must be more innovative and use modern sugarcane technologies to be more productive.
3. The sugarcane farmers should also be responsible of reporting some instances that would probably hinder the better yield and production of sugarcane in the region.
4. The Local Government Unit must also help the sugarcane farmers by catering their needs and provide helpful benefits to them.
5. The association/cooperatives of sugarcane planters may come up with long-term plans that would help farmers increase productivity.
6. Government researchers must come up with research regarding sugar production as well as determining the factors affecting production.
7. Interested researchers in the field of specialization may investigate other variables not found in the study to improve the production of sugarcane in the region.

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