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Research Article

Influence of Agricultural Extension Services for A Sustainable Sugarcane Production in the Philippines

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ABSTRACT

Agricultural extension is an essential strength in agricultural development and social innovation factor. It is a key that can capacitate sugarcane farmers to accelerate the adoption of technology in farm production. Furthermore, agricultural extension services are instrumental in bridging the gap between agricultural research and practical farming. This study aims to determine the influence of extension services on the production of sugarcane in the Philippines. Descriptive method of research was employed in the study. The respondents were 320 sugarcane farmers that were randomly identified from seven locations in the Visayas. The instrument used was the validated survey questionnaire used by Oñal, et al (2021). Results show that there is a significant difference in the production of sugarcane among location with a mean of 2.28 or an average of 50-64 TC/ha (α=0.05). The advocacy on planting of high yielding varieties (HYVs) that are adaptable to sugarcane farms (m=3.87, α=0.05) and the dissemination of different projects to the farmers (m=3.98, α=0.05) had a significant impact on sugarcane production at >65 Tons/ha. Furthermore, the two agricultural extension services mentioned are moderately correlated with the production. The study recommends that the advocacy for planting of HYVs suitable to farms should be further prioritize including the strong dissemination of various agricultural development to bolster the sugarcane production in the area.

Keywords: *Agricultural extension services, Sustainable agriculture, Sugarcane production, High-yielding varieties, Farmers training*

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Introduction

The extent of agricultural services rendered to sugarcane farmers in the Visayas do not significantly affect the level of productivity. This was the major finding by Oñal, et al (2022) on their study last 2017 at the 10 locations in the Visayas, Philippines. Hence, with the lapse of time this study is done once again to determine if agricultural extension services rendered to sugarcane farmers already on the blasting-on stage to improve the production.

Agricultural extension is one of the most important factor that can capacitate sugarcane farmers accelerate the adoption of technology and could positively correlated with farm productivity.

It is also a process of providing farmers and rural communities with knowledge, skills, and tools needed to improve agricultural productivity and livelihoods. It usually involves education, communication, and technology transfer to enhance adoption of innovation in agriculture

Furthermore, agricultural extension services are instrumental in bridging the gap between agricultural research and practical farming. It is the catalyst for disseminating knowledge, technology and best practices. Traditionally the indicators of success of agricultural extension services are measures through yield increase or adoption of technology.

Abhijeet, et al (2023) concluded that the effectiveness of agricultural extension services can be assessed through environmental, social and economic indicators. Integrating those three factors, agriculture will be more sustainable and equitable that could benefit the soil and the people in the community most especially the farmers.

Economically sugarcane industry is one of the major dollar income industries in the Philippines. Despite the continuous extent of services to the farmers' momentum on production could not be realize until this time.

On the production side, the Philippine raw sugar production for 2025 is projected to reach a volume of 1.85 million metric tons because of the improvement of weather conditions (e.g. rainfall) that could directly cater the expansion in harvest area (Pelonia, 2024). Relatively, as of February 2, 2025, the total raw sugar production in the country is 1.92 million metric tons with a total tonnage of 2.15 million or an average of 55.334 tons per hectare (SRA, 2025) way below the targeted 75 tons per hectare.

Outside of the country, it is noteworthy that sugarcane productivity in Eastern Brazilian Amazon showed a significant increase from 2012-13 to 2021-22 (Cardoso et al, 2024).

Back in the Philippines, the vast plantation are located in Regions 6, 7, and 8 specified as follows: 207,909 hectares for Region 6; 57,663 hectares for Region 7; and, 10,200 hectares for Region 8, respectively. The total area of the three regions is 275,772 hectares or 71.01% of the total area of sugarcane plantation in the Philippines (Balita, 2024).

On the number of farmers and laborers, statistics show that there are more than 80,000 farmers who are tilling the 388,378 hectares (out of the total land area of 30 million hectares devoted to agriculture), of sugarcane fields all over the country. Of the total number of sugarcane farmers mentioned-above the majority of them are considered small (farms are 5 hectares or below). In Crop Year 2015-16: 79% are small farmers, in which 17% are cultivating an area of 5.01 to 50.00 hectares and only 4% have an area of 50.01 hectares and above (Overview of the Sugarcane Industry, 2017).

The total number of agricultural and industrial workers directly employed in the industry is about 700,000. Over and above, the total workers mentioned there is an additional 70,000 more or less seasonal plantation workers who are augmenting the laborers in sugarcane plantation and estates nationwide. Relatively, the latest survey mentioned by Crisostomo (2018), indicates that sugarcane farms have 32,000 laborers, which is second to the banana plantation with 49,866 workers. Moreover, the agriculture sector has a share of 24.3% in the country's total employment (PSA, 2019).

Reza, et al (2016) had found out on their study that almost 50 percent of the cost in sugarcane farming is spend in the hiring of laborers. It indicates that sugarcane is a labor-intensive crop in Bangladesh and on average 90-110 man-days labor is needed per acre of sugarcane production.

This study aims to determine the effect of agricultural extension services in increasing the productivity of small farmers at different locations. Furthermore, this will focus also on factors that affect the sustainability of sugarcane production.

Objectives

The general objective of the study is to measure the effectivity of agricultural extension services that could affect the sustainability of sugarcane production in the Philippines.

Specifically, it aims to;

a. Gather data on the production sugarcane of the farmers in seven location;
b. Re-calibrate the effect on the production of sugarcane on the agricultural extension services rendered to farmers, and;
c. Correlate sugarcane production with the agricultural extension services given to farmers.

Methodology

The descriptive correlational study was used in this study. It focuses on the sugarcane farmers' areas, farm profile, level of production in tonnage in correlation with the extension services rendered to farmers at the seven locations of the Visayas, Philippines.

Research Environment

There are seven provinces in the Visayas where majority of the sugarcane crops are planted. For this study only six provinces is included namely: Negros Occidental, Negros Oriental, Capiz, Iloilo, Cebu, and Leyte. As of Crop Year 2021-2022, the total area cultivated with sugarcane for the above-mentioned provinces was 271,622.89 hectares and produces 15.58 million tons of cane with an average of 57.63 tons per hectare (SRA 2025).

Specifically, the study covered the following location, namely: CEB or Cebu province; LEY or Leyte; ILO or Iloilo; CAP or Capiz; BYN or Bayawan in Negros Oriental; SCR or San Carlos and VIC or Victorias for Negros Occidental. For the seven location the total area planted is 93,354.03 hectares and had produced a total of 5,073,484.90 tons with an average tonnage of 54.35 per hectare.

Distribution of the Respondents

The respondents of the study were the sugarcane farmers in the Visayan area, Philippines. Employing the *Slovins* formula, out of 18,539 (Crop Year 2021-2022) sugarcane farmers from the seven locations covered by this study, the sample size of 320 farmers were selected randomly as the actual respondents. The number of respondent was determined by computing the percentages viz-a-viz to the total number of sugarcane farmers per location. The distribution of the respondents and the sample population per location is shown on Table 1.

Table 1. Distribution of respondents per location

Location	Number of Respondents	Percentage
CEB	25	7.8
LEY	25	7.8
ILO	155	48.4
CAP	10	3.1
BYN	25	7.8
VIC	45	14.1
SCR	35	10.9
Total	**320**	**100.0**

Research Instrument

The instrument used to gather data was the validated document use by Oñal, et al (2021). It includes the farmers' profile, farm profile, land topography, soil type, duration of rainfall, and level of production among others.

Data Gathering Procedure

Instrument Preparation

The researchers had personally prepared the questionnaire/instrument.

Distribution of Instrument and Gathering and Data

The researchers had done the actual orientation on how to fill-out the questionnaire with the field enumerators. The researchers had personally distributed the instrument per location.

Thereafter, data gathering started with the assistance of agricultural enumerators at the different location.

Retrieval of Instruments

The researchers had personally retrieved the instruments from the enumerators others were send thru public courier.

Encoding and Statistical Analysis

Upon retrieval of the 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.

The procedure is presented on Figure 1.

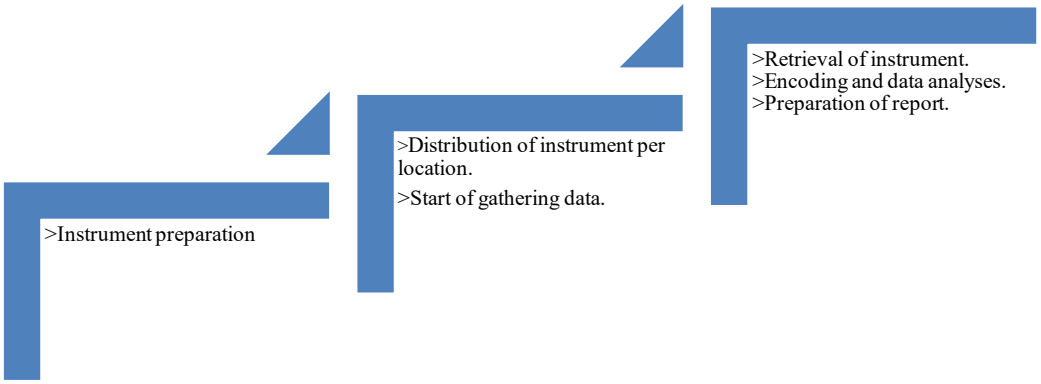

Fig. 1 Data gathering procedure

Statistical Tool

In the analysis of data, the following statistical tools were used in accordance with the nature of the specific objectives.

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

The mean was used to determine the level of production at different extension categories.

One way Analysis of Variance (ANOVA) was used to determine the difference in the level of production, when respondents are grouped according to location and extension services rendered

Pearson r Moment Correlation was utilized to determine the significant relationship between the level of production and extension services.

Results and Discussions

Profile of farmers and the farms

Table 2 and 2a revealed the farmers and farm profile at the seven location in the Visayas in terms of gender, age, level of education, number of years in sugarcane farming, average size of land holdings, and production of sugarcane.

The findings reveal that out of 320 farmers involved in the study, 69.7% are male and 30.3% are female.

Furthermore, the findings revealed that 51.2% of the farmers were 51 years old and above, 36.9% are between 36-50 years old , and 11.9% are 35 years old and below, respectively.

As to the educational attainment, 47.2% of the farmers were secondary level and 3.8% had undergone vocational courses.

The findings on Table 2 and 2a, implies that the farmers at the seven location in the Visayan area were majority male, aged 51 years old and above, secondary level, have been sugarcane farming with more than 20 years, and had a small landholding area of 25 hectares and below. Majority of the land slope ranges from 6 to

24 degrees and the average production is less than 49 TC/ha.

The findings is related with the work 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 were paid less than the male but the (low) relative pay of mothers is completely explained by productivity for women without children.

In India women perform a crucial role in agricultural either directly or indirectly starting from producing, processing and ultimately marketing of agricultural produce (Mallick & Anshuman, 2023).

Furthermore, Hyland, et al (2020) found out the global picture of gender discriminations especially on law that affects women's economic opportunity. They had find a positive correlations between a more equal laws pertaining to women workforce and more equal labor markets outcomes such as higher female labor participation and a smaller wage gap between men and women.

In the Philippines, employment in agricultural sector by gender in the year 2019 was 28.70% male and 13.60% female.

For the number of years in sugarcane farming 38.4% have been in sugarcane farming for more than 20 years, while only 26.5% have been doing it for 10 years or less.

Table 2. Farmers' profile at the different location of the Visayas, Philippines

Variables	Number of Farmers	Percentage
Gender		
Male	223	69.7
Female	97	30.3
Age		
35 years old & below	38	11.9
36-50 years old	118	36.9
51 years old & above	164	51.2
Level of Education		
Elementary	54	16.9
Secondary	151	47.2
College	103	32.2
Vocational	12	3.8
Number of Years in Sugarcane Farming		
10 years & below	85	26.6
11-20 years	112	35.0
20 years & above	123	38.4
TOTAL	**320**	**100.0**

For size of farm holding, 69.7% of the respondents have an area below 25 hectares while 6.6% have an area of 51 hectares or more.

As to the land topography, 65.3% of the area has a soil gradient of 6.24 degrees while 15.9% have a slope gradient of less than 5 degrees.

Around 53.9% of the area had an average production of less than 49 TC/ha and 18.8% have an average production of 56 to 64 TC/ha.

Table 2.a. Farm Profiles at the different location in the Visayas, Philippines.

Variables	Number of Farmers	Percentage
Average Size of Land Holdings		
51 ha & above	21	6.6
26-50 hectares	76	23.8
25 ha & below	223	69.7
Land Topography		
>25 degrees	60	18.8
6-24 degrees	209	65.3
<5 degrees	51	15.9
Average Production		
>65 TC/ha	88	27.5
50-64 TC/ha	60	18.8
<49 TC/ha	172	53.8
TOTAL	**320**	**100.0**

The extent of services rendered to sugarcane farmers in the Visayas

The data in table 3 show the mean analysis on the extent of agricultural services to sugarcane farmers in the seven locations in the Visayas was "highly extent" mean of 3.98. This means that the services extended to sugarcane farmers in the seven locations in the Visayas were above average. Likewise majority of the agricultural extension services focuses in developing the managerial skills of the farmers with six activities and a mean of 3.85.

The respondents received a "very high extent" of services in terms of the dissemination of information regarding government initiated (Sugar Industry Development Act of 2015) projects with a mean of 4.28 and the recommendation of planting HYVs' suitable and/or adaptable to be planted with a mean 4.36. The study further revealed that there are 18 areas of agricultural extension services that were rated as "highly extend."

The result implied that there's an improvement of services rendered to sugarcane farmers as compared to the previous result in 2022. For this study, there are 18 areas rated as "highly extent" and two are "very high extent", while in the previous study (2022), four areas rated as "high extent" and 16 were "moderately extent."

Relative to the study of Kosim, et al (2021) it shows that farmers who joined the program in agricultural extension increased their production at an average of 9.05 tons higher than those who have not availed the services of extension.

By category, the study of Dlamini and Worth (2016) reveal that extension is in good position to address sugarcane production challenges through improved teaching and learning, updated information management, and effective technology adoption, among others.

Pandey and Devkota (2020) found out in their study that in the absence of any organization to promote sugarcane technology extension in Nepal increasing the sugarcane production is a great challenge to farmers.

About the extension services, the agency funds its operations and projects/services to all stakeholders of the industry from their Corporate Budget (COB) and General Appropriations Acts (GAA) under the provisions of the Sugar Industry Development Act of 2015 (SRA, 2017).

Implying a study conducted by Sarimong, et al (2015) related to the services extended specifically on use of organic and sugarcane mill waste. They found out that combined use of organic and sugar mill waste (mudpress) is a factor of productivity relative on applied K, while addition of baggase ash and microbial inoculant increased physiologically the efficiency of applied K.

Table 3. The extent of services rendered to sugarcane farmers in the Visayas per category

Agricultural Extension Services by Category	Mean	Description
1.Field visits (3 services)	3.95	Highly extent
2. Technology Dissemination (4)	4.12	Highly extent
3. Distribution of Brochures/Reading Materials (1)	3.99	Highly extent
4. Conduct of Trainings/Seminars (1)	4.05	Highly extent
5. Develop Managerial Skills for Farmers (6)	3.85	Highly extent
6. Environmental Awareness (2)	4.14	Highly extent
7. Plot Demonstration (2)	3.83	Highly extent
8. Recommend HYV suitable or adaptable to be planted (1)	4.36	Very highly extent
9. Government Policy/Program Awareness (1)	4.28	Very highly extent
Total Mean	**3.98**	

Difference on sugarcane production in the Visayas, Philippines when group by category of agricultural extension services

The data in Table 4 presents the difference on sugarcane production in the Visayas, Philippines when grouped by category of agricultural extension services using One-way ANOVA. It revealed that there is a significant difference on sugarcane production when grouped by category of agricultural extension services namely. Firstly, the recommending of HYV suitable and/or adaptable to be planted with a mean of 3.87 (significant at α=0.05) with an average production of more than 65 tons/ha. Secondly, the dissemination of information on projects initiated by government with a mean of 3.98 (significant at α=0.05) with an average production of 65 tons/ha.

This indicate that sugarcane production in the Visayas, Philippines when grouped by agricultural extension services rendered to the farmers, are not comparable. Recommending HYV suitable and/or adaptable to be planted has a mean of 3.87 (significant at α=0.05) and dissemination of information regarding government initiated projects has a mean of 3.98 (significant at α=0.05), respectively.

Table 4. Analysis of Variance of sugarcane production in the Visayas, Philippines when grouped by category of agricultural extension services

Agricultural Extension Services	Mean	F	Sig
1. Recommend HYV suitable and/or adaptable to be planted	3.87	3.444	0.013*
2. Disseminating information regarding government initiated projects	3.98	4.032	0.019*
Mean	**3.92**		

**significant at 5% level*

Difference on sugarcane production in the Visayas, Philippines when group by location

The data in Table 5 presents the difference on sugarcane production in the Visayas, Philippines when grouped by location using One-way ANOVA. The study revealed revealed that there is a significant difference on sugarcane production in the Visayas, Philippines when grouped by location.

The result also indicate that sugarcane production in the Visayas, Philippines when grouped by location are not comparable. Specifically, production mean for each location are; CEB has 1.88, LEY has 2.31, ILO has 2.20, CAP has 2.13, and BYN with 2.22, respectively or an average production of 50-64 Tons/ha. The other two location classified as high production are VIC with a mean of 2.63 and SCR with 2.60 with production of more than 65 Tons/ha.

High production at VIC and SCR could be attribute to the vast plantation of high yielding varieties and a great number of trainings extended to the farmers.

Extension in agriculture has been the source of information sharing among agricultural communities for a longer time already. It

supports the dissemination of scientific findings from a research institution to the farmers in the field. Extension workers or officers ensure the gap between research and farming is minimize thus assured a sustainable agricultural growth much more on crop production (Das, et al, 2025).

Agarwal, et al (2024) revealed on their study that strengthening of farmers' knowledge through systematic education and extension services are essential in bridging the technological gap in improving the production.

Table 5. Analysis of Variance of sugarcane production in the Visayas, Philippines when grouped by location.

Location	Mean	Description
CEB	1.88	Medium production
LEY	2.31	Medium production
ILO	2.20	Medium production
CAP	2.13	Medium production
BYN	2.22	Medium production
VIC	2.63	High production
SCR	2.60	High production
Mean	**2.28**	Medium production
F	2.816	
Sig	0.011*	

**significant at 5% level*

Relationship between the agricultural extension services to farmers and volume of production

The data in Table 6 showed the relationship of the agricultural extension services provided to the farmers at the different location of the Visayas and their volume of production using Pearson's r. It could be deduced from the data that there is a moderate relationship between the agricultural extension services and sugarcane production, specifically in the dissemination of information on government initiated projects. Furthermore, the agricultural extension services rendered to the sugarcane farmers in the Visayas had a significant effect on sugarcane production.

The result of this study is much better than the previous (Oñal, et al, 2022) which show that the extent of services rendered to sugarcane farmers in the Visayas had no significant effect on the level of productivity. Henceforth the study indicates also that agricultural extension for sugarcane production in the Visayas is significantly improving.

Activating the agricultural extension services system is of great importance. Jaiswal (2014) commented that there are enough viable and modern technologies that have been develop already, but many of these have not reached to farmers because of poor delivery of extension services. Moreover, farmers are not aware of the technology available hence, they could not properly adopt them.

On the book written by Norton, et al (2020) it was cited that evaluation of extension services provided to farmers is a good indicator to determine what works, what does not and what combination of approaches is most effective. The monitoring and evaluation process is of great importance. Their writings states that there is too little learning in extension-creative thinking about the evaluation process much more on the impact of the services.

The inefficient delivery of agricultural extension services limits the use of modern technology. The lack of technical know-how and the limited financial resources were mostly a problem to farmers including the adoption of sustainable and modern agricultural practices.

Furthermore, the results of the study are directly relate to "Diffusion Theory of Innovation" by Rogers (2012).

Table 6. Correlation analysis between the agricultural extension services and volume of sugarcane production

Variables Compared	Pearson r	Sig	Strength of Relationship
Agricultural extension services Sugarcane production	0.420	0.042*	Moderate relationship

***correlation is significant at 0.05 level*

Conclusion and Recommendation

The study hereby recommend that extension services should focused its effort in disseminating information of planting HYVs adaptable to farmers area in order to increase the production for a sustainable sugarcane industry.

More trainings and demonstration be design by the government and other private institution in order to improve the information dissemination services to farmers.

Effective extension services can enhance sugarcane production especially, on the dissemination of the latest technologies. Farmers can be train as community implementers of the latest technologies and partners in community development.

Follow-up studies should be done specifically to those farmers who are holding an area of 10 hectares and below.

Conflict of Interest

No other group is involved in this study. No outside funding contributed on this study as well.

Ethical Consideration and Data Privacy

The researcher takes responsibility for securing the sanctity and confidentiality of all information/data generated through this instrument used. Data will be used for academic/research and in designing programs/projects for the industry.

The respondents agreed for publishing all generated data.

Acknowledgement

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