Acceptability Assessment of a Locally Developed Onion Harvester Hand Tractor in La Union, Philippines

[1,*]Rosalinda L. Abad, [1]Hipolito C. Buccat, [1]Zion Jemillinium S. [1]Tam-awen, and [1]Jessica A. Pagaduan
[1]*Don Mariano Marcos Memorial State University, La Union, Philippines*

Abstract—Onion farmers' attitude toward a locally developed onion harvester in the Philippines has been unstudied due to the unavailability of the machine. Based on a respondent of 26 onion farmers, an acceptability assessment of the onion harvester was implemented. Data were gathered using questionnaires at two activities of actual hands-on operation and lectures and analyzed using fisher's exact test. The ease of operation, cleaning and maintenance, safety of operation, ease of transport, technical field performance, adaptability, and investment viability were relevant attributes used in the acceptability of the onion harvester. The majority of the respondents positively accept the onion harvester. The user operation, cleaning and maintenance, ease of transport, adaptability, and investment viability are correlated positively to the willingness to buy or rent the machine. Conversely, user safety, technical performance, and aesthetics are not correlated with adoption. Since 38.5% of the farmers have no hand tractor, the preferred acquisition is renting the onion harvester.

Index Terms—acceptability assessment, hand tractor, onion harvester

I. INTRODUCTION

Mechanization is one of the factors that have the greatest impact on boosting agricultural productivity (Rivera, 2015, as cited in Negrete, 2019), enabling markets for rural economic growth, and improving rural livelihoods (World Bank Group, 2016). The most contentious form of mechanization is the adoption of harvest technologies for high-value crops because of the large amount of labor involved (Schmitz and Moss, 2015). The development of an onion harvester is a potential intervention to cater to the problems which contribute to poor production such as untimeliness, insufficient manpower supply, and high postharvest losses (Calica et al., 2018). Considering the Philippines' small-scale farming tradition, developing an onion harvester hand tractor driven that is adaptable to the local practice would respond to the call for mechanization. The machine, however, needs to be pilot tested before it can be reproduced, sold, and utilized by farmers.

* Corresponding Authour: rabad@dmmmsu.ed.ph

The focus of the pilot test is on the validation of the Agricultural Machinery Testing and Evaluation Center (AMTEC) as prescribed in Republic Act 10601 of 2013 and the socio-economic acceptability of farmers. These are requirements before it can be commercially sold in the local market. This present study centered on farmers' socio-economic acceptability as target users of the machine. Demont et al., (2001) clearly state that the socio-economic acceptability of farmers is directly proportional to the machine adoption, and only by diffusion and on-farm adaption can innovations pass their benefits to the society. Smith et al. (1994) mentioned that farmers will only accept a machine if it provides a solution to a problem keenly felt by the farm family, which means that it must be compatible with the farming system and their needs, taking technical, social, and economic factors into account. In addition, conducting a socio-economic acceptability test introduces the harvester to the wide onion farming community. Some farmers are unaware of the availability of a suitable machine that could aid in their usually tedious agricultural work (Paras and Amongo, 2004). Marra et al. (2003, as cited in Dessart, 2019) noted that information sharing is critical to the adoption of agricultural innovations within local farming systems.

With these vital roles of farmers in technology transfer, the developed onion harvester needs community acceptance through hands-on operation and perception survey. The onion harvester is designed to the local condition for a single row with 6 to 7 hills/row. It has a capacity of 299.05kg/h and a harvesting efficiency of 80.93%. The onion harvester requires labor and cost of 10man-day/ha and PhP4,419.50/ha, respectively. While manual harvesting requires labor and cost of 23 man-day/ha and PhP8,156.95/ha, respectively. The reduction of 13man-day/ha and PhP3,737.45/ha signifies additional profit to farmers. This also indicates that the machine is economically viable with a benefit/cost ratio (BCR) of 2.19. During the peak season of harvest where labor is scarce, the unpredictable weather resulting in damage/losses in the crop, and the high cost of labor; the adoption of an onion harvester could answer these problems.

In the Philippines, that onion harvesting is a manual practice, and the development of an onion harvester could pave the way for productivity in production. However, the onion harvester needs to be assessed before farmers' adoption. Thus, this present study conducted in the Province of La Union aimed to assess the farmers' perception of the acceptability of the onion harvester through hands-on field operation. Specifically, it sought to (1) determine the level of acceptability of the onion harvester attributes in terms of the ease of operation, cleaning and maintenance, safety of operation, ease of transport, technical field performance of the machine, adaptability to local field condition, and investment viability of the machine, and (2) relate the level of acceptability to the willingness of farmers to buy or rent the machine once available in the local market.

II. METHODOLOGY

Research design

The study is a descriptive research and implemented the quantitative approach to accessing the farmers' acceptability of the locally developed onion harvester. Specifically, a survey method using a questionnaire was used to gather information such as demographic profile, perception of the operation of the onion harvester, and the preferred mode of machine acquisition. Correspondingly, frequencies and percentages were used to analyze the level of acceptability and the Fisher's Exact Test to correlate the level of acceptability with the willingness of farmers to buy or rent the onion harvester. Considering that the sample size is small (n= 26) and the two (2) variables (level of acceptability and willingness to buy or rent) are in categorical data, the Fisher's Exact Test is applicable.

Instrumentation and data collection

This study implemented a survey among the two (2) onion farmers' cooperatives. These cooperatives are the project collaborators that committed their farms as field test areas for the onion harvester. These demonstration areas are located at Bauang and Aringay, La Union with an area of 2,500 m^2 each. The activities involved lectures and actual operation of the machine with onion farmers as respondents (Fig. 1). Each respondent is given 4 onion plots (25 m^2) to harvest. Purposely, to determine if the machine has ease of maneuverability/turning on the headlands.

The three-page questionnaire asked about the level of acceptability of the design, technical field performance, adaptability to local conditions, and investment viability of the onion harvester. The questions utilized the Likert-type Scale Response Anchors adopted from Vagias, (2006) (Fig.2). Levels 1 through 7 were described as "totally unacceptable"(very untrue of what I believe), "unacceptable" (untrue of what I believe), "slightly acceptable" (somewhat untrue of what I believe), "neutral", and "slightly acceptable" (somewhat true of what I believe), "acceptable" (true of what I believe), and "perfectly acceptable" (very true of what I believe), respectively.

A total of 26 respondents that operated the onion harvester were given questionnaires and collected right after the field test. It involves 7 females and 19 males. Purposely, to ascertain if the machine is gender-sensitive that could be operated by both sexes. During the answering of the questionnaire, a project staff carefully explained it to each respondent. Thus, no missing important data in the collected responses.

Figure 1. Onion farmers' hands-on operation of the onion harvester.

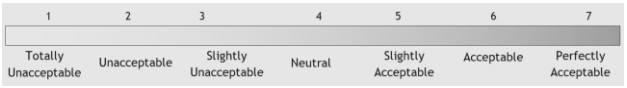

Figure 2. Acceptability Linear Numeric Scale.

Data analysis

The data analysis is dependent on the responses of onion farmers in the given questionnaire which are collected, tabulated, and finalized for computation. To meet the requirements in acquiring the percentages of the level of acceptability, each onion harvester attribute was carefully tabulated in order. This tabulated data were analyzed using IBM ® SPSS ® Statistics Version 26. After the acquisition of percentages, it was presented using a bar graph to easily visualize the result. If the responses do not cover all the 7 levels, then it will not appear as zero (0) percentage in the result. Only the levels of acceptability with responses were given importance in the analysis.

To attain the other objective of relating the level of acceptability to the willingness to buy or rent the machine, it utilizes the Fisher's Exact Test. The Pearson Chi-square could also be used however, some cells have expected counts of less than 5. Also, it is applicable for a large sample size where $n \geq 30$. From the result of the correlation, when the p-value <0.05, it is significant which indicates that the level of acceptability for a specific onion harvester attribute is important in the farmers' perception of adopting the machine. Otherwise, if the p value> 0.05, it is not significant which indicates that the specific onion harvester attribute is not a hindrance to machine acquisition.

Sample Description

The sample contains a larger fraction of males at 73.1% and 26.9% of females (Table 1) which could imply that both sexes are interested in onion harvesting mechanization. The highest educational attainment is secondary at 65.4% which could be connected to the research of Palis (2016) that farmers educate their children to be exempt from tedious farming jobs or work abroad. The age of a farmer is highest at 46-55 years old (46.3%) followed by 56-65 years old (26.9%). This could be related to Moya et.al, (2015) that farmers are decreasing due to aging. The aging of farmers and the education of farmers' children could lead to a shortage of labor in the years to come. The majority of the farmers are a member of an onion cooperative. The highest onion farming experience was at 3-6 years (43.3%) followed by 6 years and above (42.3%). It could imply that farmers are well versed in onion production. Most farmers are tenants with rent at 46.2% and during onion harvesting, the source of labor are the members of the family.

The source of income is farming. Since the cropping intensity for onion is one (1) cropping per year, farmers practice intercropping, as the main crop during the wet season is rice. The soil type for onion production is sandy loam, thus 84.6% of the farmers grew onion in this type of soil. Before onion harvesting, 61.5% practiced non-tapping of onion leaves and only onion bulbs are delivered to market. Almost the majority of the respondents have unpaved farm-to-market roads. To reduce the cost of operation, the availability of a hand tractor to power the onion harvester is necessary. However, only 61.5% owned a hand tractor and 38.5 % has no hand tractor. The ownership of hand tractors is related to Abad, (2021) that the level of mechanization in La Union, Philippines is 2.30 hp/ha; considered as low compared to other advanced countries. This indicates that not all farmers have access to machinery.

TABLE I. TABLE 1. DEMOGRAPHIC DESCRIPTION OF RESPONDENTS (N=26)

Description	Measure	Values
Gender	Male	73.1%
	Female	26.9%
Education	Elementary	7.7%
	Secondary	65.4%
	Tertiary	26.9%
Age	25-35	11.5%
	36-45	15.3%
	46-55	46.3%
	56-65	26.9%
Membership in a farmers' cooperative	Onion Cooperative	100%
Onion Farming Experience	1-3 years	14.4%
	3-6 years	43.3%
	6 years and above	42.3%
Tenure status onion farm	Owned	30.8%
	Tenanted with rent	46.2%
	Tenanted without rent	23.1%
Source of labor for onion harvesting	Family	46.2%
	Hired	38.5%
	Hired and Family	15.4%
Source of income	Farming	92.3%
	Farming and Livestock	7.7%
Cropping Intensity	Once cropping per year	100.0%
Farm soil	Sandy Loam	84.6%
	Silty Loam	11.5%
	Loam	3.8%

Farmers practice before harvesting onion	Trimmed	38.5%
	Untrimmed	61.5%
Onion product marketed	Bulbs	96.2%
	Leaves and Bulbs	3.8%
Farm to market road status	Paved	3.8%
	Unpaved	92.3%
Ownership of hand tractor	Owned	61.5%
	No hand tractor	38.5%

III. RESULTS AND DISCUSSION

The onion harvester is driven by a Philippine designed hand tractor

The onion harvester designed for the Philippine field condition (Fig. 3) is a machine that combines digging, lifting, cleaning, and collecting onion simultaneously in one operation. It is a machine that harvests a 50 cm wide plot or a single plot with 6 to 7 hills/row. The onion harvester weighs 50 kg for ease of transportation and hitching. It is mounted at the rear portion of the hand tractor through a single-point hitch.

Figure 3. Prototype onion harvester attached to hand tractor.

Level of acceptability of the onion harvester

The onion farmers' level of acceptability of the onion harvester attributes is positively rated from neutral to totally acceptable. The user operation (Fig.4) covers noise level, ease of turning/maneuverability, 60 minutes maximum duration of attaching/detaching to the hand tractor, ease of adjusting parts, and ease of conveying harvested bulbs rated neutral (3.8%), slightly acceptable (11.5%), acceptable (30.8%) and perfectly acceptable (53.8%). This indicates that 84.6% of farmers accept the design workability of the machine without certainty. However, 15.3% are doubtful. This could be attributed to maneuverability in other fields. Since the field is fragmented or divided into 4 areas and has high headlands due to flood irrigation, the transferring of the machine to other fields needs greater force, especially since 26.9% of the respondents are females.

The cleaning and maintenance (Fig.4) covering ease of cleaning parts and ease of lubrication of parts rated neutral (3.8%), slightly acceptable (14.4%), acceptable (26.9%), and perfectly acceptable (53.8%). These ratings indicate that 80.7% are certain that ease of cleaning and lubrication is manageable.

The user safety (Fig.4) covers the operator's safety from moving parts, transporting the machine, safety during maintenance, and the availability of the operator's manual rated acceptable at 80.8%. This could mean that farmers believed that the design of the machine prioritizes the safety of the operator. The availability of the operator's manual drafted following the Philippine Agricultural Engineering Standards [PAES] 102:200 increased the

farmers' perception that the provision of proper guidance during operation and safety is prioritized.

The ease of transport (Fig.4) covering the provision of side wheels, machine weight of 55 kg, and machine size of 123 cm x 57cm x 50cm (l x w x h) rated 84.6% acceptable. This could indicate that farmers believed the machine is easy to transport and size is adaptable to the hand tractor. Since the machine is hitched to the hand tractor, the design considers ergonomics for the operator to walk freely during forward operation. The remaining uncertain farmers of 15.3% could be attributed to the weight of the machine requiring 1 to 2 persons to carry during transport.

The aesthetics covering (Fig.4) the workmanship and the materials used are standard and locally available rated 80.7% acceptable. This could mean that the fabrication of the onion harvester considers outside appearance that is appealing to farmers for marketability in the local market. Since the materials used are locally accessible during repair and maintenance, thereby spare parts could be easily manufactured. This is related to the importance of spare parts as it allows farmers to formulate a smart decision on the adoption of the onion harvester. Also, the availability of spare parts could boost the acquisition of the machine (Philippine Council for Agriculture, Forestry and Natural Resources Research and Development [PCARRD], (2009). The remaining uncertain farmers of 9.6% could be attributed to the absence of spare parts readily fabricated during the hands-on operation.

The adaptability (Fig.4) covers the harvesting of sunken bed and raised bed, 50 cm working width, harvesting of trimmed onion, the reduction from manual to mechanical of 13 man-days/ha, and fuel consumption of 77.20 li/ha fuel rated 80.7% acceptable. This could mean that the farmers perceived the onion harvester as adaptable to local field conditions. Also, the fuel consumption is economical compared to the high cost of labor for manual operation. The remaining 19.2% of uncertain farmers could be attributed to not trimming onion leaves before harvesting. 38.5% of farmers practiced trimming while 61.5% practiced not trimming (Table 1). Manual trimming is practiced when the onion is harvested. Thus, it is for manual operation. However for harvesting with machinery, to prevent the blocking of onion leaves into the conveyor, trimming is recommended.

The viability of investment (Fig.4) covers the purchasing of an onion harvester at PhP42,820 per unit, fuel consumption at Php4,720, maintenance cost of the machine at PhP567.77/yr, and savings of PhP3,280/ha from manual operation cost of PhP8,000/ha rated 80.7%. This indicates that farmers perceived an increase in profit and acquisition of the machine as viable. The break-even point is 4.86 ha/yr, the payback period is 2.03 years, and the BCR is 2.19 (Abad, et al. 2022). This investment attributes point out that the machine is viable. The remaining uncertain farmers of 19.2% could be attributed to the continuous increase of fuel in the local market.

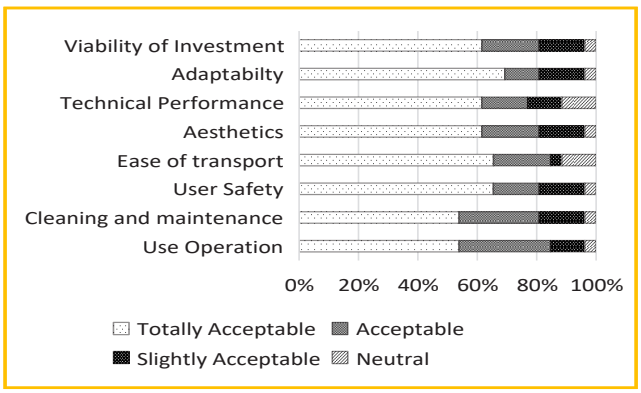

Figure 4. Level of acceptability of the onion harvester.

Level of acceptability attributes as correlated to the acquisition of the onion harvester

The intention to buy the onion harvester can be expected to be influenced by the advantages and disadvantages of mechanizing the onion harvesting operation. The major advantages include the design adopting the field conditions in the country, could answer the shortage of labor during the peak season of harvest, and the economic returns of PhP3,280/ha. The major disadvantages include the acquisition of hand tractors if unavailable, thereby, additional cost to the farmers, and the small landholdings of farmers dedicated to onion production ranging from 0.25 to 1 ha.

The results of correlating the level of acceptability attribute to the willingness to buy or rent the machine shown in Table 1, revealed 3 attributes that do not affect the farmers' perception. User safety, aesthetics, and technical field performance are significant factors in the acquisition of the machine. This could mean that farmers are not interested in the safety of operations. As the machine is easily operated and the controls are accessible to the operator. Also, there are no protrusions that could cause an accident during operation and all moving mechanisms are away from the operator. Second is the aesthetics, which could mean that farmers are not particular about the appearance of the machine as long as workable and it meets their preferences. And last is the technical field performance which could mean that farmers do not focus on the capacity and efficiency. They gave complete importance to the user operation, cleaning and maintenance, transport of machinery, adaptability, and investment viability. Based on the results, these attributes are related to their decision on willingness to buy or rent the machine. However, since the farmers' landholdings range from 0.25 to 1ha and the break-even area is 4.86 ha/yr (Abad et al, 2022), it is best to rent the onion harvester for the investment to be viable.

TABLE II. TABLE 2. RESULT OF FISHER'S EXACT TEST BETWEEN WILLINGNESS TO BUY OR RENT AND THE ATTRIBUTES OF THE ONION HARVESTER

	Attributes of the onion harvester	n	Value	p
Willingness to buy or rent	User Operation	26	6.53	0.048^{*}
	Cleaning and Maintenance	26	10.36	0.006^{**}
	User Safety	26	6.18	0.068^{ns}
	Transport of Machinery	26	8.00	0.020^{**}
	Aesthetics	26	5.87	0.108^{ns}
	Technical Performance	26	6.13	0.098^{ns}
	Adaptability	26	10.73	0.002^{**}
	Investment viability	26	7.08	0.035^{*}

* = $p < 0.05$, ** = $p < 0.01$

IV. CONCLUSION

Revisiting the objectives that lead to the exploration of the collected data, the implemented analysis yields a useful result. The actual hand on-operation and delivered lectures to the onion farmers prior to answering the questionnaire is effective as the result points out a

positive perception of the onion harvester. The attributes of the onion harvester such as user operation, cleaning and maintenance, user safety, transport of machinery, aesthetics, technical performance, adaptability, and investment viability are acceptable. Correlating this onion harvester attributes to the willingness to buy or rent, the user safety, aesthetics, and technical performance are less important. The onion farmers give greater importance on the user operation, cleaning and maintenance, transport of machinery, adaptability, and investment viability. The preferred adoption in through renting the onion harvester. Considering the small parcels of land dedicated for onion production and incomplete owning of hand tractor, it is best to rent the machine.

V. REFERENCES

[1] Abad, R. (2021). Rice Machinery Requirement in La Union, Philippines: A Basis for Prioritizing Deployment. Recoletos Multidisciplinary Research Journal, 9(2), 129-146. Available: https://doi.org/10.32871/rmrj2109.02.01

[2] Abad, R., Buccat, H., Tam-awen, ZJ., and Pagaduan, J. (2022). Investment Cost Analysis of the Developed Hand Tractor Driven Onion Harvester. Journal of Positive School Psychology 2022, Vol. 6, No. 3, 7095–7101. Available: https://journalppw.com/index.php/jpsp/article/view/4278/2823

[3] Calica, G.B., Philippine Center for Postharvest Development and Mechanization, Zeren Lucky Cabanayan, Philippine Center for Postharvest Development and Mechanization. (October 2018). Assessment of the Postharvest Systems and Losses of Bulb Onions in Nueva Ecija, Philippines. Available: https://www.researchgate.net/publication/328331412_ASSESSMENT_OF_THE_POSTHARVEST_SYSTEMS_AND_LOSSES_OF_BULB_ONIONS_IN_NUEVA_ECIJA_PHILIPPINES

[4] Demont, M., Mathijs, E., Tollens, E. Impact of new technologies on agricultural production systems: The cases of agricultural biotechnology and automatic milking. New Technologies and Sustainability, CLE-CEA, Brussels: Jean-Marc Bouquiaux, Ludwig Lauwers, Jacques Viaene, 2001, pp.11–38

[5] Department of Agriculture. (2017). Department Circular No. 05 Series of 2017, Subject: National Guidelines on Testing and Evaluation of Agricultural and Fisheries Machinery, page 1

[6] Dessart, F., Barreiro-Hurle, J., Bavel, R. (June 2019)- Behavioural factors affecting the adoption of sustainable farming practices: a policy-oriented review. *European Review of Agricultural Economics*, Volume 46, Issue 3, July 2019, Pages 417–471. Available: https://academic.oup.com/erae/article/46/3/417/5499186

[7] Moya, P., Kajisa, K., Barker, R., Mohanty, S., Gascon, F., & San Valentin, M. (2015). *Changes in rice farming in the Philippines: Insights from five decades of a household-level survey*. International Rice Research Institute. Available: http://books.irri.org/97 89712203152_ content.pdf

[8] Negrete, J. (September 2019). The Role of Agricultural Mechanization in Food Security. Journal of Agricultural Research Advances. Available: https://www.researchgate.net/publication/336471916_THE_ROLE_OF_AGRICULTURAL_MECHANIZATION_IN_FOOD_SECURITY

[9] Palis, F.G. (2020). Aging Filipino rice farmers and their aspirations for their children. Philippine Journal of Science, 149(2), pp. 351-361. Available: https://philjournalsci.dost.gov.ph/images/pdf/pjs_pdf/vol149no2/aging_filipino_rice_farmers_.pdf

[10] Paras, F. & Amongo, R. M., (2004). Technology Transfer Strategies for Small Farm Mechanization Technologies in the Philippines. Available: https://www.fftc.org.tw/htmlarea_file/library/20110726161100/eb570.pdf

[11] Philippine Council for Agriculture, Forestry and Natural Resources Research and Development [PCARRD]. (2009). Agricultural Mechanization in the Philippines. 104p. Book Series No. 179/2009. Available: http://scinet.science.ph/union/Downloads/BS%20Agricultural%20Mechanization%20in%20the%20Philippines_beta_361500.pdf

[12] Schmitz, A. & Moss, C.B. (2015) Mechanized agriculture: Machine adoption, farm size, and labor displacement. AgBioForum 18(3), 278-296. Available: http://www.agbioforum.org/v18n3/v18n3a06-schmitz.htm

[13] Smith, D.W., Sims, B.G., O'Neill, D.H., Food and Agriculture Organization of the United Nations. (1994). Testing and evaluation of agricultural machinery and equipment Principles and practices. Available: https://books.google.com.ph/books/about/Testing_and_Evaluation_of_Agricultural_M.html?id=H7PKVF-FEjUC&redir_esc=y

[14] Vagias, Wade M. (2006). Likert-type scale response anchors. Clemson International Institute for Tourism& Research Development, Department of Parks, Recreation and Tourism Management. Clemson University. Available: https://scholar.google.com/citations?view_op=view_citation&hl=en&user=HypHMUMAAAAJ&citation_for_view=HypHMUMAAAAJ:eQOLeE2rZwMC

[15] World Bank Group. (2016). Enabling the Business of Agriculture 2016: Comparing Regulatory Good Practices. Washington, DC: World Bank. doi:10.1596/978-1-4648-0772-5. License: Creative Commons Attribution CC BY 3.0 IGO. Available: https://issuu.com/world.bank.publications/docs/9781464807725

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Rosalinda L. Abad, Hipolito C. Buccat, Zion Jemillinium S. Tam-awen, and Jessica A. Pagaduan conducted the research. All authors analyzed the data, wrote the paper, and approved the final version.

ACKNOWLEDGEMENT

The researchers acknowledge the contributions of the different stakeholders in the accomplishment of this study. Appreciation is due to the Department of Science and Technology - Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD) for funding the study; to Don Mariano Marcos Memorial State University (DMMMSU) for supporting the study; and above all, to Almighty God for letting His blessings overflow.

Rosalinda L. Abad was born in Bakun, Benguet, Philippines on June 13, 1989. She completed her bachelor's degree in Agricultural Engineering at the Don Mariano Marcos Memorial State University, La Union, Philippines in the year 2012. She then enrolled and finished her master's degree in Agricultural Engineering major in Farm Power and

Machinery at the Central Luzon State University, Nueva Ecija in the year 2018.
She is currently employed as a faculty member of the Don Mariano Marcos Memorial State University handling courses related to farm power and machinery and bioprocess engineering. Her former job in the Philippine Center for Postharvest Development and Mechanization (PHilMech) as Science Research Specialist elevated her skills in the field of agricultural machinery, especially the development of machines that are efficient and economical centered on farmers' productivity.
Engr. Abad focused her research on the field of agricultural machinery and mechanization. She has published 2 papers titled "Rice Machinery Requirement in La Union, Philippines: A Basis for Prioritizing Deployment" published in Recoletos Multidisciplinary Research Journal and "Investment Cost Analysis of the Developed Hand Tractor Driven Onion Harvester" published in the Journal of Positive Psychology. Her paper titled "ANSYS Analysis and Prototype Fabrication of and Onion Harvester Implement for Hand Tractor" garnered an excellent paper award during the 13th International Conference on Environmental and Rural Development (ICERD) via online platform last March 4-5, 2022. Also, her paper titled" Design, Fabrication, and Performance Evaluation of a Hand Tractor Driven Potato Harvester" garnered the 3rd Best Paper Award (Research Category) during the 28th PSABE Annual National Convention,15th International Agricultural and Biosystems Engineering Conference and Exhibition, and 29th Philippine Agricultural Engineering Week.

Hipolito C. Buccat was born on October 18, 1962, at Bacnotan, La Union, Philippines. He finished his Bachelor of Agricultural Engineering at Don Mariano Marcos Memorial State University, Bacnotan, La Union, Philippines in 1985. His major field of study is farm machinery and irrigation.
He worked as a regional sales manager of a livestock feed company in the Philippines. He retired from his previous job and is currently a lecturer at Don Mariano Marcos Memorial State University. He co-authored a recently published paper entitled, Investment Cost Analysis of the Developed Hand Tractor Driven Onion Harvester Journal of Positive School Psychology, 2022.
Engr. Buccat is a member of the Philippine Society of Agricultural and Bio-systems Engineering (PSABE).

Zion Jemillinium S. Tam-awen was born in 1995 at Kapangan, Benguet, Philippines. He finished his Bachelor of Science in Agricultural Engineering at Benguet State University, La Trinidad, Benguet, Philippines in 2017, and his Master of Science in Agricultural Engineering at the University of the Philippines Los Banos, Laguna, Philippines in 2020. His major field of study is farm power and machinery, and agricultural crop processing.
He worked as a lecturer at Benguet State University in 2020. The following year he was hired as a Science Research Specialist at Don Mariano Marcos Memorial State University. Some of his publications include, Design, Construction, and Performance Evaluation of a Coco Peat Block Making Machine (2019), Development of a Lightweight Four-Row Paddy Drum Seeder (2020), Investment Cost Analysis of the Developed Hand Tractor Driven Onion Harvester (2022).
Engr. Tam-awen is a member of the Philippine Society of Agricultural and Bio-systems Engineering (PSABE). He was given a Young Researcher award in Bali, Indonesia in 2019. In 2021, he won the Best Paper award for his research entitled "Development of a Portable Carrot Harvester" during the 2021 International Symposium on Advanced Technology-19.

Jessica A. Pagaduan was born on October 1, 1996 at Tagudin, Ilocos Sur, Philippines. She finished his Bachelor of Agricultural Engineering at Don Mariano Marcos Memorial State University, Bacnotan, La Union, Philippines in 2018. His major field of study is farm machinery and irrigation.

She worked as a project assistant at the Department of Agriculture in January 2019 and transferred to Don Mariano Marcos Memorial State University in July of the same year. She co-authored a recently published paper entitled, Investment Cost Analysis of the Developed Hand Tractor Driven Onion Harvester Journal of Positive School Psychology, 2022.

Engr. Pagaduan is a member of the Philippine Society of Agricultural and Bio-systems Engineering (PSABE). A paper she co-authored entitled "ANSYS Analysis and Prototype Fabrication of and Onion Harvester Implement for Hand Tractor" won an excellent paper award during the 13th International Conference on Environmental and Rural Development (ICERD) last March 4-5, 2022