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Impact and Challenges of the Cashew Nut Processing System: An Analysis of Users' Experiences

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Abstract *— This study explores the impact, challenges, and adoption of the Cashew Nut Processing System (CNPS) generated by the Philippine Center for Postharvest Development and Mechanization (PHilMech). The research utilized a descriptive design, incorporating interviews and secondary data to analyze user experiences within Alion Kapit-Bisig Sea-K Association and Samahang Kababaihan ng Conversion. Findings revealed that CNPS significantly enhanced productivity, product quality, and revenue generation, as users reported streamlined operations and higher-grade products. However, transitioning from traditional methods posed challenges, including technical skill requirements, maintenance efforts, and spare part availability. Despite these constraints, the system's user-friendliness, cost-effectiveness, and positive influence on collaboration and efficiency facilitated its adoption among small-scale processors. To address identified challenges, recommendations include expanded training programs, ongoing technical support, and exploration of automation to reduce manual labor. These measures aim to enhance CNPS utilization, promote sustainable practices, and empower small-scale processors to thrive in competitive markets.*

Keywords *— **Adopters, Challenges, Cashew Nut Processing System, Productivity, Technology***

I. INTRODUCTION

In the Philippines, cashew (Anacardium occidentale L.) is called kasoy or balubad in Tagalog or Balogo in Ilokano. It originated from north-eastern Brazil and was brought to the Philippines in the 17th Century. In 2022, the top cashew nut-producing countries were Ivory Coast (970,000 mt), India (752,000 mt), Vietnam, (341,680 mt), and Philippines (217,582 mt). The Philippines maintains its place among the top four cashew producers in the world. Cashew nut production and processing is considered an important sector for many developing countries in the aspect of improving local economy and sustainable environmental development.

Being a drought-tolerant crop, it has been widely used in reforestation activities even where topography and soil are generally poor for other fruit trees to survive and/or be productive.

According to the Food and Agriculture Organization Corporate Statistical Database (FAOSTAT, 2023), cashew nut production reached 217,583 tonnes in 2022 in the Philippines. This is 15.0% less than in the previous year. Historically, cashew nut production in the Philippines reached 255,931 tonnes in 2021 and 3,468 tonnes in 1983.

Processing of cashews into value-added products such as roasted whole and split nuts, wine, and prunes, to name a few, can significantly increase the income of cashew processors. For cashew nuts alone, kernel processing can increase the income by more than thrice. The largest local market of dried or roasted cashew kernel, whether whole or broken, is Metro Manila wherein it is consumed as an ingredient in the preparation of ice cream, cakes, pastries, confectioneries, and other food preparations, as well as snack items. (PCARRD, 1999).

The usual product obtained from shelled cashews is split nuts. This is done by the use of a simple cracking tool locally called 'kalukati". The split nut has an acrid taste because cashew nut shell liquid (CNSL) that contaminates the kernel. The traditional way of extracting the kernel from the shell is inefficient resulting in low shelling recovery and high split nut or broken kernels. A study by PHilMech revealed that the primary hindrance preventing cashew growers and processors from realizing the full value of cashew nuts is the lack of suitable technology to yield CNSL-free and whole cashew kernels (Dela Cruz, Lanuza, and Rapusas, 2000).

To enhance the cashew kernel quality and elevate the profitability of processors, the Philippine Center for Postharvest Development and Mechanization (PHilMech) has designed and generated a processing system that is capable of producing high-quality nuts that consider the technical and financial capacities of small-scale processors. This involves cleaning, drying, shelling using the PHilMech's Cashew Nut Sheller, picking, sorting, roasting using the Charcoal-Fired Cabinet Oven, labeling, and packaging. Each of these stages must be carried out to produce high-quality kernels with desirable grades. Two associations adopted the technology: the Alion Kapit-Bisig Sea-K Association in Mariveles, Bataan, and Samahang Kababaihan ng Conversion in Pantabangan, Nueva Ecija.

Initially, users found the technology challenging to use, as they were accustomed to traditional processing. The CNPS required manual effort and technical know-how, which presented significant challenges. In relation to this, this study shall analyze the impact and challenges of the user's experiences using the Cashew Nut Processing System. Generally, this study aims to explore how users managed the shift to the new processing system and strategies for overcoming initial difficulties. Specifically, the study seeks to:

1. Identify the impact of the technology in terms of aspects such as productivity, product quality, and sales.
2. Enumerate the constraints and understand the challenges faced by small-scale cashew nut processors in using the technology.
3. Evaluate the impact of the technology on its adoptability, and propose strategies to enhance the cashew nut processing system.

II. METHODOLOGY

This study utilized a descriptive research design (Subia, Mangiduyos & Turgano, 2020) to describe the impact and challenges of the user's experiences in using the Cashew Nut Processing System.

Descriptive research is suitable for such studies, as it provides general information without influencing the data collected, which makes it appropriate for exploring these phenomena. This is done through an interview using a questionnaire to gather the necessary data. A review and secondary data gathering, such as data from association records and the PHilMech monitoring report, will also be reviewed to validate findings.

The researchers gathered the necessary data and information from five of the association members in each of the assisted enterprises, namely the Alion Kapit-Bisig Sea-K Association in Mariveles, Bataan, and Samahang Kababaihan ng Conversion in Pantabangan, in the province of Nueva Ecija (Fronda, 2024). They were the direct adopters and users of CNPS. The study used descriptive statistics, including frequency count, weighted mean, and percentage, to analyze the impact and challenges of the Cashew Nut Processing System among the users, particularly focusing on the users' experience. Frequency count determined how often each variable occurred, while central tendency measures, such as the mean, summarized the data.

This approach helped in assessing the different aspects of the technology impact among users and generating possible recommendations for addressing

any encountered challenges related to the experience of the users.

III. RESULTS AND DISCUSSION

1. Impact of Cashew Nut Processing System on Productivity, Product Quality, and Sales

Table 1 presents the impact of CNPS on productivity, product quality, and sales. It determines the factors that influence these variables. The results presented in Table 1 show the impact of the Cashew Nut Processing System on the Productivity, Product Quality, and Sales. Respondents strongly agreed that CNPS had increased productivity, as demonstrated by a weighted score of 3.8. This indicated its effectiveness in enhancing production efficiency and output. Similarly, the system had improved the quality of processed cashew kernels, also scoring 3.8, which indicated that the technology contributed to producing higher-grade products that aligned with market and consumer standards. The CNPS has also established its ability to streamline operations by reducing the processing time, with a weighted score of 3.6. Furthermore, respondents agreed that the adoption of CNPS has led to an increase in product sales and revenue, another area where it scored 3.6, showing its impact on market performance and profitability. Additionally, the system enabled the production of a wider variety of value-added cashew products, as highlighted by a 3.6 score. This emphasized that the technology provided additional value to the product. Overall, the average weighted mean was 3.7, with a rating of Strongly Agree.

Table 1. Impact of Cashew Nut Processing System on Productivity, Product Quality, and Sales

STATEMENT	WEIGHTED MEAN	VERBAL DESCRIPTION
a. The CNPS has significantly increased the productivity of our cashew nut processing.	3.8	Strongly Agree
b. The CNPS has improved the quality of processed cashew kernels.	3.8	Strongly Agree
c. The technology has contributed to a reduction in processing time.	3.6	Strongly Agree
d. The adoption of CNPS has led to an increase in product sales and revenue.	3.6	Strongly Agree
e. The CNPS allows for the production of a wider variety of value-added cashew products.	3.6	Strongly Agree
Average Weighted Mean	3.7	**Strongly Agree**

2. Challenges and Constraints in Using Cashew

Table 2 presents the challenges and constraints faced in using the Cashew Nut Processing System (CNPS). The findings highlight areas that may affect the full potential of the system.

According to Table 2, some factors restrict the activities of users of the Cashew Nut Processing System (CNPS). The corresponding mean rating of 2.9 which falls under the "Agree" level indicates that users consider the system to be fairly easy to use, but some features of the system can be improved. The evaluation for start-ups and learning activities was 2.6, this means that users encounter problems when transitioning to the new system. Likewise, considering the technical skills needed to operate and take care of CNPS, the score recorded was 2.4, this position is quite challenging to users and would require better training and maintenance organization for this system.

Table 2. Challenges and Constraints in Using the Cashew Nut Processing System

STATEMENT		WEIGHTED MEAN	VERBAL DESCRIPTION
a.	The initial setup and learning process for using the CNPS was challenging.	2.6	Agree
b.	The manual effort required for operating the CNPS is manageable.	3.8	Strongly Agree
c.	The technical knowledge needed to operate the CNPS was difficult to acquire.	2.4	Agree
d.	The maintenance of the CNPS requires effort.	2.4	Agree
e.	The availability of replacement parts and technical support is sufficient.	2.6	Agree
f.	The cost of adopting and operating the CNPS is affordable for our association.	3.8	Strongly Agree
Average Weighted Mean		2.9	**Agree**

On the other hand, users strongly agreed that the manual effort required to operate the system was manageable, placing a high score of 3.8 on all the system's operations. This indicated the simplicity of the system regarding day-to-day activities. The cost involved in acquiring and running the CNPS also rated

3.8, indicating that the reasonable cost was one of the factors that encouraged users to adopt the technology, especially in small-scale enterprises. However the presence of spare parts and the technical assistance obtained, even though ranked at 2.6, makes it possible to see further improvements in the experience and even satisfaction of users of the system. The CNPS is used for its affordability and its operation mostly by hand, there are problems related to its technical training, maintenance and spare parts provision, and support. Overall, the average weighted mean was 2.9, with a rating of Agree.

3. Adoption and Utilization of the Cashew Nut Processing System

Table 3 presents the adoption and utilization of the Cashew Nut Processing System (CNPS). It determines the factors of the processing practices as well as some factors responsible for its utilization.

Table 3 presents an overview of how the Cashew Nut Processing System (CNPS) has been adopted and utilized within the association. The first statement, which addresses the transition from traditional tools (kalukati)/manual to CNPS, received a weighted score of 3.6, which shows that the respondents' transition in using the technology was easy. The second statement, concerning the adequacy of the training provided to help members

effectively use CNPS, scored 3.4, also reflecting strong agreement that the training was sufficient. The third statement evaluated the user-friendliness and ease of integrating CNPS into existing workflows which shows the same score of 3.6. This suggests that most respondents found the system easy to use and incorporate.

Table 3. Adoption and Utilization of the Cashew Nut Processing System

STATEMENT	WEIGHTED MEAN	VERBAL DESCRIPTION
a. The transition from traditional tools (*kalukati*) to CNPS was smooth.	3.6	Strongly Agree
b. Adequate training was provided to help us use the CNPS effectively.	3.4	Strongly Agree
c. The technology is user-friendly and easy to integrate into existing workflows.	3.6	Strongly Agree
d. CNPS has been successfully adopted by most members of our association.	3.4	Strongly Agree
e. The system has enhanced collaboration and efficiency within the association.	3.8	Strongly Agree
Average Weighted Mean	**3.6**	**Strongly Agree**
Overall General Weighted Mean	**3.4**	**Strongly Agree**

Regarding the adoption of CNPS by association members, the third statement scored 3.4, indicating strong agreement that the system has been widely embraced. Lastly, the statement about the system enhancing collaboration and efficiency within the association received the highest weighted score of 3.8. This shows that CNPS has significantly improved both teamwork and operational efficiency. The average weighted mean for all five statements was 3.6, indicating a general average of strong agreement about the positive impact and successful adoption of CNPS. Overall, the responses show that CNPS has been well-received, with members who find it user-friendly, well-supported by training, widely adopted, and beneficial in enhancing collaboration and efficiency within the association.

IV. CONCLUSIONS

The following conclusions were made based on the results and discussions:

1. The majority of respondents using the Cashew Nut Processing System (CNPS) have significantly improved productivity, product quality, and revenue generation for users. The system's efficiency in streamlining operations and enabling the production of high-quality, market-ready products emphasizes its value for small-scale processors.
2. While the CNPS has proven beneficial, users faced challenges during the transition from traditional methods, primarily due to the manual effort required, the technical skills needed, and the maintenance requirements. These factors highlight the need for additional training and technical support to ensure sustained utilization.
3. The CNPS has been adopted and is well-regarded for its user-friendly design and cost-effectiveness. Adequate training joined with collaboration within associations, has facilitated successful adoption and utilization. However, addressing constraints such as spare parts availability and modernization needs can further boost long-term sustainability.

V. RECOMMENDATIONS

The following were recommended based on the conclusion and findings of the study:

For CNPS users, participate in training to enhance the use of the CNPS and build technical skills.

1. PHILMECH, as the technology generator, should continuously provide problem-oriented training to new adopters and users. This training should address technical challenges, operational best practices, and maintenance procedures to ensure that users maximize the benefits of the CNPS. PhilMech should continuously provide technical assistance for repairs, establish links with manufacturers to guarantee the availability of spare parts, and conduct regular monitoring of processed product quality, sales volumes, and enterprise progress to ensure its sustainable development (Balaria, et al., 2017).
2. While the CNPS is user-friendly, efficient, and accessible for small-scale operators, however, PHilMech should consider exploring modernization opportunities to incorporate automation into the process. This would reduce reliance on manual labor enabling associations to save time and reduce labor costs while meeting the demands of an evolving business landscape. Transitioning towards semi- or fully automated solutions could further enhance productivity and allow users to scale their operations sustainably.

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