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Communication Factors Influencing Farmers' Determinants of Behavioral Intentions Toward the Adoption of the Mechanical Rice Transplanter: A Theory of Planned Behavior Approach

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Abstract

The mechanical rice transplanter is an innovative agricultural machine designed to transplant rice seedlings efficiently into paddy fields. Despite its clear benefits, adoption among farmers remains limited. Communication plays a crucial role in shaping farmers' perceptions and behavioral intentions toward technology adoption. Guided by the Theory of Planned Behavior, this study examines how communication factors—source, message, and channel—influence farmers' determinants of behavioral intentions to adopt the mechanical rice transplanter. This study surveyed 186 rice farmers in Barangay Catalanacan, Science City of Muñoz, Nueva Ecija. Results revealed that communication factors—source ($r = 0.279$, $p < 0.001$), message ($r = 0.272$, $p < 0.001$), and channel ($r = 0.375$, $p < 0.001$)—are all positively and significantly associated with attitudes. Among these, the communication channel demonstrated the strongest relationship, underscoring the critical role of delivery mechanisms in shaping favorable attitudes toward behavioral intent to adopt the mechanical rice transplanter. Specifically, IEC materials and social media such as Facebook, YouTube, and TikTok were the most effective platforms and the most efficient channels for informing farmers about the rice transplanter. In terms of content, the survey found the machine's benefits and optimal planting times to be appropriate and factual. Findings also showed that farmers preferred receiving further information through a combination of training/seminars, printed materials, and virtual platforms, noting that the information significantly increased their farming knowledge. In addition, rice farmers agreed that the rice transplanter is an effective machine that is easy to use and efficient. Based on these findings, the study formulated several recommendations to improve information dissemination and, ultimately, cultivate behavioral intentions to adopt the adoption.

Introduction

Agriculture is the foundation for improving food quality and the nutrition it provides. Good agricultural practices produce good-quality crops. As noted by Trading Economics (2023), agriculture is one of the most vital sectors of the economy, providing income for about 24.27% of Filipino workers in 2021. Rice is a grain crop and has become an important food in Philippine cuisine. Many Filipinos cannot eat a meal without rice. It also provides 21% of global human per capita energy and 15% of per capita protein (International Rice Research Institute, 2023).

It also holds historical and cultural significance, as it is often associated with rituals, traditions, and cultural practices.

Furthermore, according to the Philippine Statistics Authority (2020), the largest rice-producing regions in the country are Central Luzon (19.8%), Cagayan Valley (14.1%), Western Visayas (11.0%), Ilocos Region (9.8%), MIMAROPA (6.4%), and 6.3% for SOCCSKSARGEN and Bicol Region. In Central Luzon, Nueva Ecija has consistently led the region and the country in rice production. Because of this, Nueva Ecija is known as the rice granary of the Philippines, home to the Municipality of Science City of Muñoz.

Back in the day, farmers planted rice by hand, bending over in muddy fields; it was backbreaking and time-consuming. This creates problems because it is time-consuming, labor-intensive, and costly; the same issues apply to rice harvesting, which puts food security at risk. According to Bordey *et al.* (2016) in Competitiveness of Philippine Rice in Asia, the Philippines has laborious practices in crop establishment, crop care and maintenance, and harvesting and threshing, similar to Indonesia and India. Several Asian rice-producing countries already use mechanized harvesting that combines cutting, threshing, and cleaning. These practices have already been accepted and implemented in the Philippines.

An innovation was created to address the backbreaking, time-consuming process of planting rice. This innovation is called a rice transplanter. Climate change undeniably affects the world, especially the Philippines. A rice transplanter is an agricultural machine that transplants rice seedlings into paddy fields. This machine consists of a mover, transmission, engine, lugged wheels, seedling tray, seedling tray shifter, and pick-up tool. These agricultural technologies are developed to boost agricultural productivity, as the Philippines is considered one of the most labor-intensive countries in Asia (Bordey *et al*., 2016).

In addition, rice transplanters come in two types: riding and walking. The Riding type can be operated with an electric motor and can transplant six to eight lines in a single pass (Philippine Center for Postharvest Development and Mechanization [PHilMech], n.d.-a). In contrast, the walking type can be operated manually and can transplant only four seedlings in a single pass (PHilMech, n.d.-b). This machine reduces planting time compared to traditional methods, requires only a few laborers, increases productivity, and produces uniform seedling spacing, enabling farm owners to maximize yields compared with manual transplanting (Asha and Babu, 2020).

Generally, innovation takes time to be fully accepted and implemented by the community; mechanized harvesting practices have followed the same pattern. Although this technology offers significant benefits to farmers, its adoption rate remains low relative to other rice farm machinery (Francisco *et al*., 2019). Thus, it is not surprising that rice transplanters are still not accepted and fully implemented by rice farmers. This innovation requires extensive education and information on the benefits and optimal use of the rice transplanter. There are many ways through communication factors that can help educate and disseminate information to rice farmers regarding the rice transplanter, such as Information, Communication, and Education (IEC) materials, publication materials, and seminars that will influence the behaviors (Alberto, 2019) and perceptions of the farmers to adopt agricultural innovations (Mardiharini *et al*., 2023).

According to Ani *et al.* (2018), rice farmers are more open to using rice farm machinery such as transplanters and combine harvesters if they have large rice fields, access to training opportunities, or long farming experience. Farmers perceived that using rice machinery provides higher profit than manual labor, which has lower production costs (Mardhiah *et al*., 2020). Irmayani *et al.* (2024) noted that rice farmers often lack the necessary skills to operate modern machinery. To address this, implementing innovative communication strategies during training can increase farmers' interest in using rice transplanters, utilizing machine facilities, and strengthening agricultural institutions. Although studies exist on rice, few examine rice transplanter use; moreover, few studies address rice transplanters in the Philippine local context, which this study aims to address.

The Theory of Planned Behavior (TPB) posits that a person's behavior is driven by their behavioral intention, which represents one's conscious plan, decision, and commitment to perform a target behavior (Conner, 2020; Ajzen, 1991). Using this theory, the study focuses on identifying farmers' perceptions using the TPB constructs (attitude, subjective norms, and perceived behavioral control) to understand disruptions in technology utilization, even though rice transplanter technology continues to have a low adoption rate and low relative utilization among farmers (Francisco *et al*., 2019).

The rice transplanter maximizes productivity and profit while reducing environmental damage, planting time, and labor. This study examined the communication factors that shape rice farmers' perceptions, which in turn influence their behavior and attitude toward their intention to use rice transplanter technology. This study contributes to the local context by identifying the communication factors that affect the intention to adopt non-mainstream agricultural machinery, specifically rice transplanters.

Conceptual and Theoretical Framework

The study aimed to identify the communication factors (source, message, and channel) that influence rice farmers' perceptions and intent to use the rice transplanter. To support the study, the study adopted the Theory of Planned Behavior (TPB) variables as the theoretical framework to assess the identified communication factors. The TPB posits that an individual's attitude, subjective norms, and perceived behavioral control influence their behavioral intention (Ajzen, 1991).

This study examined how communication factors, as independent variables, influence the determinants of behavioral intentions toward the mechanical rice transplanter, which serve as the dependent variables. These dependent variables—attitude toward the behavior, subjective norms, and perceived behavioral control—were adopted from TPB. Socio-demographic characteristics of the respondents were included for descriptive purposes to contextualize respondents but were not statistically correlated with the main variables).

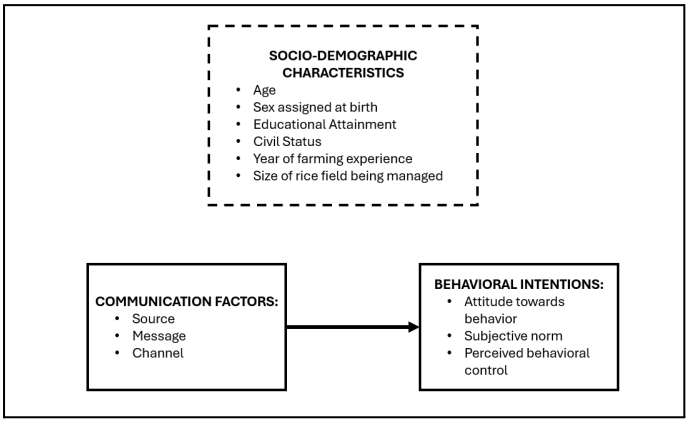

Figure 1. Conceptual framework of the study

Objectives of the Study

This study's main focus is to determine the communication factors affecting rice farmers' perceptions of rice transplanters in Catalanacan, Science City of Muñoz, Nueva Ecija. Specifically, it aims to:

1. Determine the profile of the rice farmers of Catalanacan, Science City of Muñoz, Nueva Ecija in terms of: (a) Age, (b) Sex assigned at birth, (c) Educational attainment, (d) Civil Status, (e) Years of experience in farming, and (f) The size of the rice field being managed.
2. Determine the communication factors affecting the rice farmers in terms of: (a) Information Source, (b) Message Content, and (c) Communication Channels/platforms.
3. Determine rice farmers' attitudes, subjective norms, and perceived behavioral control toward mechanized rice transplanters.
4. Determine the communication factors affecting rice farmers' attitude, subjective norm, and perceived behavioral control.
5. Determine how rice farmers' attitude, subjective norm, and perceived behavioral control affect their perceived behavioral intentions to use mechanized methods for rice transplanting.

Hypothesis of the Study

1. Communication factors are significantly related to rice farmers' attitude toward their intention to use mechanized rice transplanters.
2. Communication factors, subjective norms, and perceived behavioral control are not significantly related to rice farmers' intention to use mechanized methods for rice transplanting.

Review of Related Literature

Rice Establishment and Transplanter Technology

Good crop establishment, or planting, is the first step toward successful cropping (Alam *et al*., 2020). Crop establishment refers to the series of events that begin with planting crop seeds, germination, emergence as seedlings, and growth to the point at which they can be expected to reach maturity. It is an important part of rice and wheat production technology (Das *et al*., 2021). Planting at the right time in a well-prepared field helps produce a crop that grows quickly and uniformly, resists pests and diseases, and yields more (DA-PhilRice and KOPIA Center Philippines, 2018).

Farmers can establish crops using two methods: direct seeding and transplanting (Bareja, 2022). According to Tababa (2023), in the Philippines, farmers adopt five major transplanting methods: wet-bed transplanting, dry-bed transplanting, mechanized transplanting, the dapog system, and direct transplanting.

Wet-bed transplanting is the most commonly used rice planting method in the Philippines, where farmers plant rice seedlings in well-prepared plots with water management features.

Mechanized rice planting methods use machines or technology to plant rice seedlings in the field, such as a rice transplanter. By ensuring uniform planting distance and depth, this method reduces the need for manual, labor-intensive work, improving overall efficiency and precision (Tababa, 2023).

The rice transplanter is a technological advancement in planting machinery that moves rice seedlings onto rice plants or fields (Saleh *et al*., 2018). Additionally, as Saleh *et al*. (2018) note, planting rice seedlings is one of the most labor-intensive procedures in rice production. Hence, a rice transplanter speeds up the planting process and helps alleviate labor shortages.

Mechanical rice transplanters significantly improve seedling planting in small- and medium-scale fields by enhancing efficiency, precision, and operational ease (Rajendran & Ranganathan, 2025). This machine can simplify and speed up paddy farming by automating most of the physical labor required to plant rice. It reduces the need for intensive manual labor and farming expenses.

Intention for Adoption of Farm Machineries

If farmers have accurate, relevant information, they are more likely to adopt agricultural innovations (Bello & Yahia, 2017). Information about agricultural technologies and innovations can give farmers new knowledge about sustainable agriculture and likely increase their productivity and income. In addition, farmers often lack sources of information about modern agricultural innovations that could help them improve their farming practices unless government agencies intervene.

Governments and development organizations have long promoted agricultural innovations to increase farm commodity production and reduce poverty; however, adoption remains low (Ruzzante *et al*., 2021). Governments and development organizations, especially extension workers, play a significant role in farmers' adoption process because they can influence and educate farmers about modern agricultural innovations.

Onyeneke (2017) observed that farmers aged 41 to 50 years are likely to be willing to adopt new and improved rice farming practices. In addition, he found that "old" farmers, those with more farming experience, are the ones who will quickly adopt modern rice farming systems. This is because these farmers are more knowledgeable in agriculture; hence, they have more knowledge and experience of what they need to do to increase crop productivity, as well as their needs.

Communication in Agriculture

Change agents must keep up with farmers if they want to improve the agricultural industry and support farmers (Parmar, 2020). This is only possible through communication. Communication means sharing or exchanging ideas or information between individuals or groups. Communication is a vital tool for linking information about agricultural innovations and technologies to farmers, especially those without proper communication channels to receive the information needed to enhance their agricultural capacity.

In addition, Caseja and Vargas (2021) found that farmers are exposed to various communication materials, such as print materials, television, and seminars, which could help them increase their agricultural production. This suggests that the communication media or platforms government extension workers use significantly affect farmers and their agricultural resilience.

As Ducker (2023) notes, communication connects farmers, stakeholders, and other industry professionals, giving them access to crucial information such as weather patterns, market prices, and new technologies to support decision-making. However, certain communication factors hinder farmers from adopting or acknowledging innovations and technologies, such as language barriers and a lack of resources to access information, as reflected in farmers' perceptions. Bello and Yahia (2017) stated that the complexity of human behavior frequently causes numerous issues in the communication process.

Attitude Towards Agricultural Machineries

As Hasan *et al*. (2020) stated, farmers' attitudes toward agricultural mechanization are crucial to adoption. In their study entitled "Farmers' Attitude towards Farm Mechanization", they found that most of the farmers have a negative attitude towards agricultural mechanization or are not at a satisfactory level.

Farmers' attitudes toward agricultural mechanization, such as rice transplanters, significantly affect adoption. An individual's attitude toward a behavior affects their evaluation of that behavior's performance; for example, the performance of agricultural machinery in the field, such as a rice transplanter.

Subjective Norms About Agricultural Machineries

According to Mohammadrezaei *et al.* (2023), subjective norms significantly influence advisors' reluctance to discuss farm health and safety. In their study, they examined how subjective norms among agricultural advisors affected the dissemination of information on farm health and safety. They found that these norms shaped advisors' attitudes and behaviors, leading to apparent hesitation in addressing these critical topics. Agricultural machinery, an essential tool in modern farming, is not exempt from these norms. The adoption, use, and

maintenance of agricultural machinery can profoundly affect a farm's productivity, efficiency, and sustainability. Consequently, policymakers and stakeholders must understand the role subjective norms play in shaping farmers' attitudes toward agricultural machinery.

Subjective norms about agricultural machinery can also impact farmers' decisions to invest in new technologies or maintain existing equipment. Previous studies have demonstrated that several factors influence farmers' adoption of innovative farming practices and machinery, including perceived benefits, access to financial resources, and risk perceptions. Thus, understanding how subjective norms intersect with these factors is essential for creating an environment conducive to the sustainable use of agricultural machinery.

Perception Toward Agricultural Machinery

According to Kernecker *et al*. (2020), farmers' perceptions of smart farming technologies for cropping systems have been a topic of interest in recent years. The study aimed to evaluate farmers' experiences and expectations across Europe regarding the use of advanced agricultural machinery for crop management. The findings indicated significant variation in adoption levels and perceived utility across the technologies studied. Some participants enthusiastically embraced certain advanced agricultural machinery, while others met it with skepticism or disinterest. Factors shaping these perceptions included farm size, technical knowledge, access to financial resources, and regional differences in agricultural practices.

A notable correlation emerged between experience and expectation. Farmers who had direct experience with smart farming technologies were more likely to hold positive perceptions about their potential impact on crop performance and farm management. As a result, those with firsthand experience had higher expectations for future advancements in agricultural machinery than those without such experience.

Materials and Methods

Research Design

The study employed a quantitative descriptive correlational research design. The descriptive component characterized the variables, while the correlational component examined relationships between variables, such as the relationship between rice farmers' sociodemographic characteristics and their behavioral intentions.

Research Locale

The study was conducted in Barangay Catalanacan, Science City of Muñoz, Nueva Ecija. This rural, lowland barangay has the highest rice farmer population in the Science City of Muñoz.

Respondents and Sampling

The researchers selected respondents using simple random sampling from the 358 registered rice farmers in Barangay Catalanacan. This method gave rice farmers an equal chance to be selected to participate in the study. Using a 95% confidence level and a 5% margin of error in a sampling calculator, the researchers calculated a sample size of 186 rice farmers.

Research Instrument and Validation

The researchers used a self-constructed questionnaire to collect data. The crafted research instrument consists of four parts: (1) socio-demographic profile of rice farmers, (2) communication factors, (3) effects of the communication factors, and (4) behavioral intentions. External experts checked the research statements. Before conducting the study, the 51 items in the instrument underwent pre-testing with 30 sampled respondents. The researchers used Cronbach's alpha analysis to ensure the instrument's internal consistency and reliability, with scores ranging from 0.724 (Acceptable) to 0.933 (Excellent). To adapt the instrument to the community's local language, the researchers also translated it into Tagalog.

Data Analysis

The researchers used descriptive statistics, including frequency, mean, mode, percentage, and standard deviation. The researchers used the Spearman correlation coefficient to determine the relationship between the variables, specifically between the communication factors received by the rice farmers and their attitudes, subjective norms, and perceived behavioral control.

Ethical Considerations

The researchers followed ethical guidelines throughout the research process. The researchers administered an informed consent form to ensure respondents fully understood the study's goals, objectives, and purpose. In compliance with the Data Privacy Act of 2012, respondents were assured that their answers, particularly their personal information, would be kept strictly confidential and used solely for academic purposes.

Additionally, the researchers sought approval from the University's Ethics Review Committee (ERC) before data collection. Because the study involves human subjects through a survey, this step ensures compliance with ethical standards.

Results and Discussion

Socio-demographic Profile of the Respondents

The study surveyed 186 respondents on their socio-demographic profiles, including age, sex assigned at birth, educational attainment, civil status, years of farming experience, and the size of the managed rice field. Table 1 presents the socio-demographic profile of the respondents. The results show that the largest age group consisted of individuals aged 51 to 60 years, representing 34.41% of the sample, followed closely by those aged 61 years and above at 29.57%. This distribution indicates that a significant portion of respondents are older, suggesting substantial farming experience. The table also shows that the vast majority of the respondents were male (141 responses).

Table 1. Socio-demographic characteristics of the respondents

Socio-demographic Characteristics		Frequency (f)	Percentage (%)
Age	30 and below	5	2.69
	31 – 40	20	10.75
	41 – 50	42	22.58
	51 – 60	64	34.41*
	61 and above	55	29.57
Sex Assigned at Birth	Male	141	75.81*
	Female	45	24.19
Educational Attainment	Elementary Level/Graduate	41	22.04
	Highschool Level/Graduate	82	44.09*
	College Level/Graduate	63	33.87
Civil Status	Single	8	4.30
	Married	149	80.11*
	Separated	10	5.38
	Widow/Widower	19	10.22
Years of Experience in Farming	Below 10 Years	30	16.13
	11 – 20 Years	40	21.51
	21 – 30 Years	50	26.88*
	31 – 40 Years	42	22.58
	41 – 50 Years	20	10.75
	50 Years and Above	4	2.15
Size of the Rice Field Being Managed	Less Than 1 Hectare	42	22.58
	1.00 – 2.00 Hectares	99	53.23*
	2.01 – 3.00 Hectares	23	12.37
	3.01 – 4.00 Hectares	9	4.84
	4.01 and above	13	6.99

Furthermore, the data reveal that the highest educational attainment for nearly half of the respondents was high school (44.09%). This implies that a large segment of the population attained or completed their secondary education. In terms of civil status, most respondents were married (80.11%, 149 responses). Moreover, the most common range of rice farming experience was 21 to 30 years (26.88%), followed by 31 to 40 years (22.58%; 42 responses). Furthermore, most respondents (53.23%) managed 1 to 2 hectares of rice fields, followed by 22.58% who managed less than 1 hectare. These results suggest that most respondents are small-scale farmers.

Communication Factors

Source

Table 2 shows that social media was the most efficient platform for disseminating information about rice transplanters, gathering 51 responses in "Often". This was followed by co-farmers (78 responses), relatives (64 responses), and Department of Agriculture training and seminars (59 responses), all falling under "Sometimes." The mean score for social media is 2.80 with a standard deviation of 1.25, indicating greater diversity in farmers' responses and showing that their sources of information were less uniform.

According to Guntukogula Pattabhi *et al.* (2023), farmers frequently utilize various social media platforms to search for news or information regarding agricultural development. In their study, most respondents gained substantial knowledge about agricultural technologies through social media. Setu *et al.* (2023) reported similar findings, noting that Information and Communication Technology (ICT), specifically social media, aided the rice farmers in accessing agricultural information. Additionally, Duhan and Singh (2017) found that the country's agricultural department served as a primary source of information for many respondents. In contrast, Idowu *et al.* (2020) observed that a significant portion of their respondents also received agricultural technology information from relatives and co-farmers.

Table 2. Information source on rice transplanter

Particulars	No. of Respondents (n = 186)								
	Never	Rarely	Sometimes	Often	Always	Mode	Mean	Standard Deviation	Description
Training and Seminar of the Department of Agriculture	54 (29.03%)	32 (17.20%)	59 (31.72%)	40 (21.51%)	1 (0.54%)	3	2.47	1.14	Sometimes
Private Corporation	88 (47.31%)	59 (31.72%)	32 (17.20%)	7 (3.76%)	0 (0%)	1	1.77	0.87	Never
Co-farmers	21 (11.29%)	37 (19.89%)	78 (41.94%)	47 (25.27%)	3 (1.61%)	3	2.86	0.98	Sometimes

Relatives	34 (18.28%)	45 (24.19%)	64 (34.40%)	39 (20.97%)	4 (2.15%)	3	2.65	1.07	Sometimes
Printed Materials	56 (30.11%)	71 (38.17%)	46 (24.73%)	11 (5.91%)	2 (1.08%)	2	2.10	0.94	Rarely
Social Media	39 (20.97%)	37 (19.89%)	46 (24.73%)	51 (27.42%)	13 (6.99%)	4	2.80	1.25	Often

Message

Table 3 shows that "Benefits of using a rice transplanter" has a mode of 3, followed by "Importance of using a rice transplanter," which also has a mode of 3. Furthermore, "Training on how to use a rice transplanter" and "Do's and don'ts on how to use a rice transplanter" also have a mode of 3. Based on the items, the means averaged 2.68, with standard deviation scores ranging from 0.717 to 0.749. This shows strong agreement among respondents on the message content received by rice farmers.

Findings showed that the respondents agreed they received the information presented in Table 3, as it had an overall mode of 3. This indicates that the respondents received information covering various topics related to the rice transplanter. As Getahun (2020) stated, agricultural information is a vital component of improving agricultural production for small-scale farmers. In line with this, Mohapatra *et al.* (2023) noted that agricultural information can help farmers make decisions about fieldwork, capital, and management. They also added that farmer groups comprise many users for whom information needs are vital.

Table 3. Message content received by the rice farmers on rice transplanter

Statements	Frequency (n=186)	Mode	Mean	SD	Description
Benefits using rice transplanter	128	3	2.73	0.72	Agree
Training on how to use rice transplanter	114	3	2.66	0.73	Agree
Importance of using rice transplanter	119	3	2.70	0.72	Agree
Do's and Don'ts on how to use rice transplanter	107	3	2.62	0.75	Agree
Overall	**468***	**3**	**2.68**		**Agree**

*Legend: 4 Strongly Agree, 3 Agree, 2 Disagree, 1 Strongly Disagree; * multiple response*

Channel

Table 4 shows that Facebook was the most efficient virtual platform for disseminating information about the rice transplanter, with a mode of 3. This indicates that respondents often used Facebook as a communication tool and a source of information. Moreover, YouTube and TikTok also had a mean of 3, demonstrating that they are efficient platforms for disseminating information about the rice transplanter. Consistent with the message, the means averaged 2.45, with standard deviation scores ranging from 0.930 to 0.972. This shows strong agreement among respondents regarding the virtual platform rice farmers use to receive information about the rice transplanter. Alam and Uddin (2018) also found that most respondents used Information and Communication Technology (ICT) to gather agricultural information. Jabeen and Gul (2023) also presented promising results, finding that social media, particularly Facebook, was an effective tool and played a significant role in promoting sustainable agriculture.

The findings indicate that virtual platforms such as Facebook, YouTube, and TikTok are efficient channels of information for the respondents, as evidenced by an overall mode of 3. This implies that these virtual platforms are effective and convenient for the respondents. According to Jabeen and Gul (2023), social media has become an important tool that has transformed communication and information dissemination. They also added that social media platforms such as Facebook and YouTube have become online platforms for information sharing, raising awareness, and promoting cooperation and partnership among individuals, communities, and organizations enthusiastic about sustainable agriculture.

Table 4. Virtual platforms as channel for message received by rice farmers on rice transplanter

Statements	Frequency (n=186)	Mode	Mean	SD	Description
Facebook	92	3	2.64	0.97	Agree
YouTube	94	3	2.44	0.93	Agree
TikTok	66	3	2.26	0.96	Agree
Overall	**252***	**3**	**2.45**		**Agree**

*Legend: 4 Strongly Agree, 3 Agree, 2 Disagree, 1 Strongly Disagree; * multiple response*

Table 5 shows the channels through which respondents received information about the rice transplanter, specifically the channels used by the Department of Agriculture (DA) and private corporations. Based on the results, the printed materials, training and seminars, and virtual platforms utilized by the Department of Agriculture and private corporations were efficient in disseminating information about the machinery. This is supported by data showing that all stated channels had a mean of 3. Consistent with these findings, message content and virtual channels had a mean of 2.55, with standard

deviations ranging from 0.877 to 0.913. This shows that the rice farmers had a high level of agreement regarding the usefulness of various channels, such as print materials, trainings and seminars, and virtual platforms. They agreed that these platforms are relevant channels for receiving information from government agricultural agencies.

Overall, respondents agreed that the communication channels used by the DA and private corporations were effective, as shown by an overall mode of 3. This indicates that these channels successfully disseminated information, allowing rice farmers to receive it.

Table 5. Channel of the message received on rice transplanter from the Department of Agriculture and private corporation

Channel of Message Received	Frequency (n=186)	Mode	Mean	SD	Description
Printed Materials	103	3	2.46	0.88	Agree
Training and Seminar	111	3	2.55	0.88	Agree
Virtual Platforms	111	3	2.65	0.913	Agree
Overall	**325***	**3**	**2.55**		**Agree**

*Legend: 4 Strongly Agree, 3 Agree, 2 Disagree, 1 Strongly Disagree; * multiple response*

Table 6 shows respondents' preferences for the channels through which they want to receive information about the rice transplanter. The results indicate that respondents preferred training and seminars, printed materials, and virtual platforms, as each channel had a mode of 3. Overall, respondents strongly agreed that they wanted to attend training and seminars to gain additional knowledge and experience, and to receive information through printed materials and virtual platforms to better understand the rice transplanter.

Overall, the preferred channels for receiving information had a mean of 3.45, with standard deviations ranging from 0.676 to 0.877. This shows that rice farmers strongly agreed that they prefer receiving information through training, printed materials, and virtual platforms. Their agreement indicates that these are accessible channels for the farmers to receive information on agricultural technologies and agricultural machinery.

Table 6. Preferred information channel on receiving information on rice transplanter

Preferred Channel	Frequency (n=186)	Mode	Mean	SD	Description
Training and Seminar	113	4	3.50	0.17	Strongly Agree
Printed Materials	112	4	3.52	0.86	Strongly Agree
Virtual Platforms	97	4	3.32	0.88	Strongly Agree
Overall	**322***	**4**	**3.45**		**Strongly Agree**

*Legend: 4 Strongly Agree, 3 Agree, 2 Disagree, 1 Strongly Disagree; * multiple response*

Effects of Communication Factors

Table 7 presents the impact of communication factors on respondents' perceptions of rice transplanter use. The mean values, which indicate the average level of agreement on a Likert scale, were utilized to assess the effects of information received.

The statement "My farming knowledge increased with the information I gathered about rice transplanter" had a mode of 3, indicating the effect of communication factors on rice farmers. This statement also had the highest mean of 2.87, with a standard deviation of 0.756. This shows strong agreement with the statement, with diverse responses from the rice farmers.

These results suggest that the respondents gained more knowledge about farming through the information they received from the communication materials provided to them. This was followed by findings showing that the respondents became aware of the benefits and importance of the rice transplanter, and because of this information, they agreed to use it. The findings suggest that communication factors, as reflected in the acquired information, positively influenced respondents' views on rice transplanter usage, as shown by an overall mode of 3. The consistent agreement across multiple statements indicates a cohesive and favorable perception among the surveyed individuals regarding the potential benefits of using the rice transplanter in agricultural practices.

Table 7. Effect of communication factors to rice farmers

Statements	Frequency (n=186)	Mode	Mean	Standard Deviation	Description
The information I received regarding the rice transplanter was beneficial to me.	116	3	2.81	0.73	Agree
The information I received regarding the rice transplanter influences me to try and know more about the machine.	108	3	2.77	0.74	Agree
My farming knowledge increased with the information I gathered about rice transplanter	119	3	2.87	0.76	Agree
I was enlightened on the benefits or importance of the rice	113	3	2.86	0.79	Agree

transplanter through the information I gathered.					
It was clarified to me through the information I received that we can save more in farming with the use of a rice transplanter.	111	3	2.80	0.75	Agree
Because of the information I received, it was clarified to me that our farming will be easier with the use of a rice transplanter.	107	3	2.77	0.77	Agree
Because of the information I received, it was clarified to me that the rice transplanter is easy to use.	109	3	2.77	0.77	Agree
Because of the information I received, I think using the rice transplanter will help me in farming.	110	3	2.82	0.77	Agree
Because of the information I received, I think the rice transplanter will help me in improving my life and of my family.	102	3	2.71	0.79	Agree
Because of the information I received, I agree to use a rice transplanter in farming.	91	3	2.84	0.84	Agree
Overall	**1086***	**3**	**2.80**		**Agree**

*Legend: 4 Strongly Agree, 3 Agree, 2 Disagree, 1 Strongly Disagree; * multiple response*

Behavioral Intentions on Rice Transplanter

Attitudes

Table 8 shows the positive and negative attitudes towards the transplanter. Respondents agreed with the statement, "If I use a rice transplanter, it would make our rice planting easier," with a mean of 3.04 and a mode of 3. This was followed by the statements, "Rice transplanter is good for planting" and "Rice transplanter is more economical," both with a mean of 2.97 and 2.90, respectively, and a mode of 3. The standard deviations ranged from 0.528 to 0.71. This shows a high level of agreement among farmers regarding their positive attitude toward the rice transplanter.

All three statements consistently received agreement from the respondents, resulting in an overall mode of 3. This indicates that respondents largely agree in favor of using the farming machine. Ramana and Lavanya Kumari (2019) reported similar findings, with most respondents showing a positive attitude toward agricultural machinery. They suggested that farmers accept agricultural machinery despite its high cost and limited availability. This positive attitude stems from the knowledge that agricultural machinery can improve farm management, boost harvest yields, increase economic efficiency, and reduce labor costs (Huo *et al.*, 2022).

Meanwhile, Table 8 reveals that the respondents disagreed with the statement, "The use of a rice transplanter in farming is just an additional expense," which achieved a mode of 2. This indicates that most of the rice farmers are aware that using the machinery can lessen their expenses. The statements, "The rice transplanter is difficult and complicated to use" and "The rice transplanter is not an effective farming machine," both also received a mode value of 2. The standard deviations ranged from 0.642 to 0.689, showing that the rice farmers had a high level of agreement in disagreeing with negative attitudes toward rice transplanters. This indicates that the rice farmers' attitudes toward the machine are positive.

Table 8. Attitude of rice farmers towards rice transplanter

Attitude	Frequency (n=186)	Mode	Mean	SD	Description
Positive Attitude					
Rice transplanter is good for planting	136	3	2.97	0.56	Agree
Rice transplanter is more economical	130	3	2.90	0.57	Agree
If I use a rice transplanter, it would make our rice planting easier	134	3	3.04	0.53	Agree
Overall	**400***	**3**	**2.97**		**Agree**
Negative Attitude					
The use of rice transplanter in farming is just an additional expense.	118	2	2.11	0.68	Disagree
The rice transplanter is not an effective farming machine.	118	2	2.06	0.642	Disagree
Rice transplanter is difficult and complicated to use.	120	2	2.11	0.69	Disagree
Overall	**356***	**2**	**2.09**		**Disagree**

*Legend: 4 Strongly Agree, 3 Agree, 2 Disagree, 1 Strongly Disagree; * multiple response*

Overall, the statements received an overall mode of 2, which corresponds to a description of disagreement. This result indicates that the rice farmers disagreed with the negative statements regarding the rice transplanter and are aware of the importance and benefits of the machinery. This finding aligns with the study by Lyngdoh and Mazhar (2022), where the majority of their respondents held a

positive attitude toward the importance of farm machinery and its usage. Generally, these findings indicate that the respondents are likely to adopt and use a rice transplanter based on their positive attitude toward its use and benefits.

Subjective Norms

Table 9 shows that most of the respondents believed that the rice transplanter is an effective piece of farm machinery, achieving an average mean of 2.72 and a mode of 3. Moreover, the statements regarding the belief in their community that the machine is easy to use, and that using the rice transplanter could reduce agricultural expenses, also had a mode value of 3. The standard deviation scores ranged from 0.540 to 0.803, which indicates that the rice farmers have a high agreement on the positive subjective norm on the rice transplanter.

The table shows that the respondents and their community held positive beliefs and understandings regarding the rice transplanter, as evidenced by an overall mode of 3. Huo *et al*. (2022) reported similar findings, noting that most of their respondents, especially farmers who do not own agricultural machinery, were strongly influenced by the subjective norms toward farm machinery. These results imply that the positive beliefs, perceptions, and social norms of the community positively influenced the respondents' own views toward the rice transplanter, potentially increasing their intention to use the machinery.

Table 9. Subjective Norms of rice farmers towards rice transplanter

Subjective Norms	Frequency (n=186)	Mode	Mean	SD	Description
Positive Subjective Norms					
In our community, it is believed that the rice transplanter will greatly help our farming and our family	120	3	2.70	0.56	Agree
In our community, it is believed that the rice transplanter is an effective farm machinery	129	3	2.78	0.54	Agree
In our community, it is believed that the rice transplanter is easy to use	126	3	2.76	0.58	Agree
In our community, it is believed that using a rice transplanter could reduce our agricultural expenses	116	3	2.74	0.61	Agree
All of my relatives and acquaintances will agree if I decided to use a rice transplanter	95	3	2.63	0.80	Agree
Overall	**586***	**3**	**2.72**		**Agree**
Negative Subjective Norms					
In our community, it is believed that the rice transplanter will only destroy the livelihood of the farm laborer	69	2	2.58	0.97	Disagree
In our community, it is believed that the rice transplanter is not an effective farm machinery	108	2	2.16	0.65	Disagree
In our community, it is believed that the rice transplanter is complicated and difficult to use	94	2	2.20	0.74	Disagree
In our community, it is believed that using a rice transplanter could only increase our agricultural expenses	90	2	2.20	0.76	Disagree
In our community, it is believed that using a rice transplanter will only reduce our income	93	2	2.23	0.75	Disagree
Overall	**454***	**2**	**2.27**		**Disagree**

*Legend: 4 Strongly Agree, 3 Agree, 2 Disagree, 1 Strongly Disagree; * multiple response*

In contrast, respondents expressed mixed opinions on negative subjective norms across five statements. The first statement had a mean of 2.58 and a mode of 2, indicating that respondents disagreed with the belief in their community that the rice transplanter would destroy the livelihood of farm laborers. Subsequently, the remaining statements also had means ranging from 2.16 to 2.23 and a mode of 2, indicating that respondents disagreed. Overall, the respondents showed uncertain understanding and knowledge about the rice transplanter.

According to the findings in this section, the data show an overall mean of 2.27 with a mode value of 2, which corresponds to the rice farmers' disagreement with negative subjective norms. The standard deviation ranged from 0.654 to 0.974, indicating a high level of agreement in disagreeing with negative subjective norms toward the rice transplanter.

Consistent with the table above, these findings suggest that the respondents held positive subjective norms

toward the rice transplanter. This alignment could stem from the positive influence of their community, which ultimately shapes the respondents' behavior toward the machinery. Li and Wu (2021) also found that social norms positively influenced and directly affected their respondents' intentions to use organic fertilizer.

Perceived Behavioral Control

Table 10 shows the three statements regarding positive perceived behavioral control. Respondents agreed with the first statement, indicating their confidence that using a rice transplanter helps ease rice planting. This statement achieved a mean of 2.91 and a mode of 3. The second statement, with a mean of 2.89 and a mode of 3, showed that respondents consider the rice transplanter easy to use. Furthermore, the third statement, with a mean of 2.87 and a mode of 3, showed that the respondents agreed that using the farm machine offers more benefits.

The statements received an overall mean of 2.89 and a mode of 3, indicating respondents' agreement. The standard deviation scores ranged from 0.537 to 0.636, showing a high level of agreement among the rice farmers regarding their positive perceived behavioral control over the rice transplanter.

These results are consistent with studies by Huo *et al*. (2022) and Mardhiah *et al*. (2020), which reported similar findings in which most respondents viewed the use of farm machinery as economically beneficial. According to Mardhiah *et al.* (2020), these results could be attributed to the benefits the rice transplanter provides to rice farmers.

Table 10. Perceived behavioral control of rice farmers towards rice transplanter

Perceived Behavioral Control	Frequency (n=186)	Mode	Mean	Standard Deviation	Description
Positive Perceived Behavioural Control					
I think the rice transplanter is easy to use	131	3	2.89	0.56	Agree
Using a rice transplanter has more benefits	114	3	2.87	0.64	Agree
I am confident that the use of a rice transplanter will help to ease our planting of rice	131	3	2.91	0.54	Agree
Overall	**376***	**3**	**2.89**		**Agree**
Negative Perceived Behavioral Control					
The rice transplanter is not good and is ineffective	128	2	1.98	0.60	Disagree
Using a rice transplanter will only increase our expenses and workloads	103	2	2.05	0.72	Disagree
Using a rice transplanter will only reduce our income	110	2	2.10	0.71	Disagree
Overall	**341***	**2**	**2.04**		**Disagree**

*Legend: 4 Strongly Agree, 3 Agree, 2 Disagree, 1 Strongly Disagree; * multiple response*

Table 10 also shows that respondents disagreed with all the negative statements. The first statement they disagreed with stated that using a rice transplanter would reduce their income; it had a mean of 2.10 and a mode of 2. The second statement, which stated that using a rice transplanter would increase their expenses and workload, had a mean of 2.05 and a mode of 2. Finally, the third statement, which stated that the rice transplanter is not good and is ineffective, had a mean of 1.98 and a mode value of 2. Their standard deviation scores ranged from 0.602 to 0.717, indicating a high level of agreement in disagreeing with the negative perceived behavioral control statements regarding the rice transplanter. Overall, the findings reveal that the respondents disagreed with the negative statements, as evidenced by an overall mode value of 2.

Mardhiah *et al*. (2020) similarly found that their respondents held a highly positive perception of the rice transplanter because of the benefits it provides to rice farmers. Overall, these findings suggest that respondents recognized the rice transplanter's importance and benefits, particularly in financial outcomes, reduced working hours, and labor efficiency.

Correlational Analysis

In Table 11, it is seen that there is a significant relationship between rice farmers' attitudes towards rice transplanter and messages of the information they received with a correlation coefficient at 0.272. Additionally, the results also showed a higher significant relationship between rice farmers' attitudes towards rice transplanter and channels of the information they received with 0.375 correlation coefficient. Hossain *et al*. (2011) similarly found that a more positive attitude toward technology leads farmers to seek more agricultural information, which in turn enhances their perception and awareness.

The study suggests that there was a significant relationship between farmers' attitudes towards rice transplanter and the source, message, and channels of

information they received. This suggests that the type of information farmers receive about the farming machine influences their attitude towards its use.

In conclusion, the study demonstrates a significant relationship between farmers' attitudes toward the rice transplanter and the sources, messages, and channels of information they received. This suggests that the characteristics of the information farmers receive about the farming machine directly influence their attitude toward its use.

Table 11. Correlation between communication factors and behavioral intentions

Communication factors and behavioral intentions	Correlation Coefficient (*r*)	p-value
Communication factors and attitudes		
Source	0.279*	<0.001
Message	0.272*	<0.001
Channel	0.375*	<0.001
Communication factors and subjective norms		
Source	0.322	<0.001
Message	0.326	<0.001
Channel	0.342	<0.001
Communication factors and perceived behavioral control		
Source	0.322	<0.001
Message	0.369	<0.001
Channel	0.361	<0.001

**significant at the 5% level of significance*

Conclusion

Rice farmers perceived information effectively through social media platforms such as Facebook, YouTube, and TikTok, which were the most efficient platforms for respondents to receive information about the benefits and seasonal planting times of rice transplanters. Respondents considered the messages appropriate and fact-based. Rice farmers preferred receiving information through training/seminars, printed materials, and virtual platforms, noting that the information increased their farming knowledge and positively impacted them. It is agreed that the rice transplanter is an effective farm machine that would simplify their work.

In essence, communication factors influence farmers' attitudes toward using rice transplanting machines, which shapes their intention to adopt them. This underscores the role of effective communication strategies in promoting the acceptance of mechanized agricultural machinery and practices. Specifically, communication factors (source, message, and channel) are significantly related to farmers' attitudes and their intention to use rice transplanters.

Utilizing effective communication channels can significantly influence rice farmers to form positive perceptions of innovative machinery and technologies. Such communication is vital for driving meaningful changes in farming practices, ultimately ensuring that farmers benefit from integrating these technologies into their agricultural activities. Because this research was conducted at the barangay level, it paves the way for further exploration of localized communication strategies for agricultural technologies. Introducing new agricultural technologies still poses a challenge in terms of influencing traditional farmers. Therefore, analyzing these communication factors with other theories is essential to identifying the most effective methods for promoting widespread adoption.

Recommendation

Based on the conclusions drawn, several recommendations emerged by the researchers to enhance the dissemination of information about rice transplanters among rice farmers in Catalanacan, Science City of Munoz:

1. Establish targeted, user-friendly social media promotions about rice transplanters and other agricultural technologies, considering that most respondents in this study are aged 51 to 60 years old and above.
2. Develop and distribute informative printed materials that comprehensively cover the advantages of utilizing rice transplanters;
3. Conduct tailored training programs and seminars for rice farmers that tackle specific needs and challenges faced by small-scale farmers and the efficient use of rice transplanters.
4. Encourage rice farmers in the area to participate in training programs and seminars on rice transplanters and other agricultural technologies.
5. Include several barangays as the study setting to gather more meaningful data on the communication factors that affect farmers' perceptions of rice transplanters and other agricultural technologies.

Ethical Statement

The study provided participants with an informed consent form that outlined the research procedure, including its objectives and purpose. Data Privacy Act of 2012 (Republic Act No. 10173) was also highlighted, assuring respondents that their responses and personal information would be kept in strict confidence and used solely for the research.

Conflict of Interest Statement

The authors declare no conflict of interest related to the conduct and publication of this research. All procedures followed were in accordance with institutional and ethical standards, and there were no financial or personal relationships that could have influenced the outcomes of this study.

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Declaration of Generative AI and AI-Assisted Technologies

During the preparation of this work, the authors utilized Grammarly for the grammar improvement and checking of spellings and punctuations. Following the use of this tool/service, the authors conducted a review and made necessary modifications, assuming full responsibility for the content of the publication.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions

MDRT: Conceptualization, Writing - Original Draft, Investigation, Data Curation; **CKRL:** Conceptualization, Writing - Original Draft, Investigation, Data Curation; **GRTI:** Conceptualization, Writing - Original Draft, Investigation, Data Curation; **ZDCV:** Supervision, Writing - Review and Editing; **PCES:** Conceptualization, Supervision. Writing - Review and Editing,

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