Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 24, Issue 3, 2024
PRINT ISSN 2284-7995, E-ISSN 2285-3952

ORDERED LOGISTIC MODELS FOR THE STAGES OF ADOPTION OF VEGETABLE TECHNOLOGIES

Leomarich F. CASINILLO[1*], Cristita A. CLAVA[1], Milagros C. BALES[1**], Melbert O. HUNGO[2]**

[1]Visayas State University, [*]Department of Mathematics, [**]Department of Agricultural Education and Extension, Visca, Baybay City, Leyte, Philippines; E-mails: leomarichcasinillo02011990@gmail.com, cristitaclava@gmail.com, milagros.bales@vsu.edu.ph
[2]Southern Leyte State University-Tomas Oppus, Teacher Education Department, Southern Leyte, Philippines, E-mail: mhungo@southernleytestateu.edu.ph

Corresponding author: leomarichcasinillo02011990@gmail.com

Abstract

This study aimed to explain the level of adoption of vegetable technologies among the youth members of 4-H clubs in some parts of Southern Leyte, Philippines, and expose its governing predictors. The data gathering employed cross-sectional and primary information among the 118 youth members selected in the form of a census. The study used a researcher-developed research instrument adapted from existing studies in the literature. The collected data were summarized using some standard descriptive metrics in statistics and an ordinal regression model was constructed to determine the predictors of vegetable technology adoption. The findings revealed that there are only a few youth members are implementing (8.47%) and adopting (4.24%) the vegetable technologies even if they have positively perceived the 4-H coordinator. The regression model revealed that youth members are more like to implement the vegetable technology if they have a higher income (p-value<0.1), they have no financial debt (p-value<0.01) and they learned from an effective 4-H coordinator (p-value<0.1). Furthermore, the ordered regression model revealed that youth members are going to implement (p-value<0.01) and adopt (p-value<0.01) the technology if it is not complex to follow. Conclusively, the local government must support the youth members regarding the financial aspect, and by providing expert agricultural extension agents to guide them in implementing and adopting the vegetable technologies.

Key words**:** *youth, 4-H club, vegetable technology, adoption, ordered regression analysis*

INTRODUCTION

Vegetables are important parts of plants that are consumed as food by humans which is a source of minerals and vitamins. In the journey toward maintaining a balanced and nutritious diet, vegetables play a crucial role, presenting a varied spectrum of shapes, colors, and flavors to cater to diverse tastes and nutritional needs. Their significance lies in nutrient density, as vegetables are not only low in calories but also rich in essential nutrients such as vitamins A and C, potassium, folate, and dietary fiber [1], [9], [22].Consuming a variety ensures a broad spectrum of benefits, promoting digestive health and aiding in weight management. Many vegetables boast antioxidants, protecting cells from free radical damage and reducing the risk of chronic diseases. Regular consumption is linked to a lower risk of health conditions, while diverse preparation methods highlight their culinary versatility[29], [40], [44]. Incorporating a vibrant variety of vegetables into daily meals is integral to maintaining overall well-being and sustaining a balanced and nutritious lifestyle.

Originally established in the United States, the 4-H club has evolved into a global youth development organization, symbolizing Head, Heart, Hands, and Health. Rooted in the late 19th century, it began as a rural youth program focused on agricultural and home-based skills but has expanded to cover science, technology, engineering, arts, and mathematics (STEAM) [2], [16], [17]. The 4-H club's mission is to create a supportive and inclusive environment for young individuals, emphasizing life skills, leadership, and responsibility through hands-on projects and activities. Diverse educational programs span areas like agriculture, science, healthy living, and citizenship, allowing youth to actively participate and learn through

practical experiences [4], [5], [17], [27]. Leadership development, community service, and civic engagement are integral focus areas, with camps and events enhancing personal growth and camaraderie. While originating in the United States, the 4-H club has adapted globally, playing a vital role in shaping the lives of young people through leadership skills, community engagement, and a commitment to lifelong learning [8], [12].

Youth members, aged 12 to 24, constitute a dynamic segment of society undergoing significant physical, cognitive, emotional, and social development. Recognizing diversity based on cultural background, socioeconomic status, and individual experiences is crucial during this critical period of identity formation. Active engagement in formal education or skill development programs highlights the importance of access to quality education. Participation in civic activities and social initiatives reflects a growing awareness of social issues and a desire to contribute positively to communities. Growing up in a digital age, youth members adeptly utilize technology, influencing their social interactions and perspectives on global issues [20]. They face challenges, including academic pressures, peer influences, and the transition to adulthood, requiring supportive environments and resources. Numerous youth organizations and programs globally support their development, emphasizing education, leadership, skill-building, mentorship, and personal development [33].

Government policies are crucial for the growth and effectiveness of 4-H clubs, encompassing financial support, regulatory frameworks, and collaboration initiatives. Financial allocations impact the ability of 4-H clubs to operate, while regulatory frameworks ensure alignment with educational standards and safety guidelines [27]. Policies may outline collaboration with other educational institutions or community organizations, reinforcing the positive impact of 4-H clubs on youth development. The transition from youth to adulthood involves decisions about education, career paths, and personal relationships, requiring supportive networks, mentorship, and guidance [11], [45]. The adoption of vegetable technology represents a holistic strategy incorporating innovative practices and advancements in cultivating, processing, and distributing vegetables. Precision farming and smart agriculture tools optimize planting patterns and improve resource efficiency. Biotechnology and genetic engineering lead to genetically modified vegetables with enhanced resistance and increased yield [23], [25]. Hydroponics and vertical farming minimize environmental impact and enable year-round cultivation. Automation and robotics address labor shortages, while the Internet of Things and sensor technologies provide real-time data for decision-making. Data analytics aid in crop planning and risk management. Post-harvest technologies preserve vegetable quality, and market access technologies ensure transparency. Effective extension services and training programs are vital for educating farmers about technology benefits [10], [36],[39]. Adopting vegetable technology enhances productivity, resource efficiency, and sustainability, requiring collaboration, ongoing research, and continuous education for farmers to fully harness these advancements [24].

The exploration of topics such as "vegetable,""4-H club,""youth members,""government policy to 4-H club," and "adoption of vegetable technology" offers a comprehensive view of agriculture, youth development, and technology adoption [14], [31]. Noteworthy research gaps warrant further investigation to deepen our understanding. Research on vegetables could explore sustainable cultivation practices, considering environmental impact, resource efficiency, and agricultural system resilience. For the 4-H club, evaluating program effectiveness in fostering youth development, leadership, and community engagement is crucial, along with investigating inclusivity and diversity. Exploring the impact of 4-H club participation on the mental health and well-being of youth members, as well as educational outcomes, provides valuable insights. Assessing government policies' impact on 4-H club growth and conducting a comparative analysis of policies supporting youth development worldwide are vital. According to [21], in the

realm of vegetable technology adoption, investigating factors influencing smallholder farmers and exploring emerging technologies contribute to a nuanced understanding. Addressing these gaps enables researchers and practitioners to significantly contribute to informed decision-making and the development of policies promoting sustainable agriculture and youth development.

The research objective to investigate the adoption of vegetable technologies among 4-H club youth in Southern Leyte, Philippines, is crucial. It informs agricultural innovation, revealing how younger generations engage in sustainable farming amid technological advancements. This insight is vital in an era shaping agricultural landscapes. The study also impacts youth development and education, offering insights into the effectiveness of agricultural programs. Uncovering how participation influences knowledge and skills informs future strategies. Crucially, it aids policymakers, guiding targeted policies for sustainable agriculture, and contributing to regional economic development. Socially, it explores the youth's role in shaping local agriculture, revealing the potential for community engagement and leadership development in sustainable agriculture.

MATERIALS AND METHODS

The Framework and Research Design

In the paper of Rogers [38], innovation adoption involves five (5) stages such as (a) awareness, (b) interest, (c) decision, (d) implementation, and (e) adoption. In that case, the awareness stage can develop a curiosity that leads to interest in the use of technology. When the farmer is now interested in the new learning, then it is more likely to make a decision on what to do next, that is, the implementation. If the farmer has found it useful and economically practical, then the final stage is adoption. It is viewed in [13] and [15] that the adoption of technology is governed by the following factors namely (1) demographic profile, (2) economic variables, (3) technological and institutional factors, (4) constraints and problems. Hence, this study adopted the complex-correlational research design to elucidate the governing factors of adoption stages and formulate a plan of action or policy that promotes sustainability for vegetables.

Locale, respondents, Sampling, and Ethics

The researchers noticed that 4-H clubs are actively operating in Southern Leyte, Philippines wherein they have conducted seminars and workshops influencing the youth members and other people residing in the place to the benefits and strength of vegetable technologies. Hence, the researchers decided to conduct the survey, particularly in the municipalities that include Maasin City, Tomas Oppus, Hinunangan, Saint Bernard, and Macrohon where 4-H clubs are highly influential. The dotted portion with red color in the map below is the location of Southern, Leyte, Philippines (Fig. 1).

Fig. 1. Location of the survey (dotted with red). Source: [19].

In each survey area, the number of members is manageable, hence, the study employed a census known as complete enumeration. In fact, the advantage of complete enumeration is that accurate information about the desired population is more likely obtained [28]. Table 1 presents the distribution of 4-H club members as respondents of this survey research.

Hence, this study surveyed the 118 youth members of the 4-H club in regard to the adoption stages of vegetable technologies. The study has implemented an ethical procedure as follows: (1) a formal letter of consent to the higher authorities was accomplished prior to

the conduct of the study, and (2) respondents were informed that their cooperation to the said survey is voluntary and information gathered from them is solely used for this paper only.

Table 1. 4-H club members

Municipality	Barangay	Number of Members
Hinunangan	Sto. Niño I	23
Tomas Oppus	San Isidro	20
Maasin City	Mahayahay	25
St. Bernard	Panian	25
Macrohon	Guadalupe	25
Total	**-**	**118**

Source: Authors' own constructions (2024).

Survey Instrument and Data Collection

The researchers had read the literature (see [13], [15], [34], [41]) and came up with a developed semi-structured questionnaire for the survey. The content of the questionnaire is the following: (1) demographic profile; (2) influence profile of 4-H club members; (3) rating of vegetable technology characteristics; (4) effectiveness of 4-H club coordinator; and (5) stages of adoption of vegetable technologies.

As for youth members' demographic profiles, they were asked about their age, sex, education, educational status, monthly income, household size, and credit access. Secondly, for the influence profile, they were asked if they were convinced by the 4-H club members, family members, and through agricultural training.

Thirdly, the youth members were asked to rate from 1 to 5 scaling in regard to the vegetable technology characteristics.

In addition, they were asked also about the effectiveness of the 4-H coordinator with 1 to 5 scaling.

Table 2 below shows the interval perception scores that the mean might fall, the linguistic description, and its corresponding level of effectiveness.

Table 2. Guidelines for vegetable technology characteristics and 4-H coordinator ratings

Interval perception scores	Verbal Description	Level of effectiveness
4.21 – 5.00	Strongly agree	Highly effective
3.41 – 4.20	Agree	Effective
2.61 – 3.40	Neutral	Uncertain
1.81 – 2.60	disagree	Ineffective
1.00 – 1.80	Strongly disagree	Highly ineffective

Source: Authors' own constructions (2024).

For the last section of the questionnaire, the youth members were asked about their stages of adoption regarding vegetable technologies with 1 to 3 scaling. The different levels of adoption with their corresponding perception score intervals and verbal interpretation are presented in Table 3 below.

Table 3. Levels of adoption and its description

Levels	Perception scores	Verbal description
Awareness	1.00-1.60	Not aware
	1.61-2.30	Slightly aware
	2.31-3.00	Aware
Interest	1.00-1.60	Not interested
	1.61-2.30	Slightly interested
	2.31-3.00	Interested
Decision	1.00-1.60	Rejected
	1.61-2.30	Moderately decided
	2.31-3.00	Decided
Implementation	1.00-1.60	Not Implemented
	1.61-2.30	Slightly implemented
	2.31-3.00	Implemented
Adoption	1.00-1.60	Not adopted
	1.61-2.30	Slightly adopted
	2.31-3.00	Adopted

Source: Authors' own constructions (2024).

Empirical Model and Data Analysis

When the survey was done, collected data from the respondents were then encoded into Microsoft Excel and coded to transform the qualitative response into quantitative. Additionally, the data were properly aligned to suit for STATA statistical package calculation. For the researchers to describe and give insights to the data, appropriate statistical measures were calculated namely, counts (n) and percentages (%), mean (M), and standard deviation (SD). Moreover, bar graphs and statistical tables were constructed to present the statistical calculations. The dependent variable in this study is the levels of adoption which is ordinal in nature (Scale of 1 to 3). Hence, in determining the statistical predictors of the stages of adoption, ordinal logistic regression was employed in the data inference analysis. The empirical model of this study is as follows:

$$Y_i = \alpha_0 + \alpha_1 Age_i + \alpha_2 Male_i + \alpha_3 Educ_i + \alpha_4 EducStat_i + \alpha_5 Income_i + \alpha_6 Inf4Hmem_i + \alpha_7 Inffam_i + \alpha_8 Training_i + \alpha_9 Complex_i + \alpha_{10} Econ_i + \alpha_{11} Compa_i + \alpha_{12} Esafe_i + \alpha_{13} Minrisk_i + \alpha_{14} Credit_i + \alpha_{15} Effcoor_i + \varepsilon_i \ldots\ldots (1)$$

where: Y_i = Awareness$_i$, Interest$_i$, Decision$_i$, Implementation$_i$, Adoption$_i$, and can take the values of 0, 1, and 2 in view of Table 3 and the concept of ordered logistic model. In model (1), i=1,2,...,118 (youth members of 4-H club), Age_i represents the age (in years) of youth members, $Male_i$ is dummy variable that refers to a male youth member (0-female, 1-male), $Educ_i$ refers to the level of education (1-elementary level, 2-elementary graduate, 3-high school level, 4-high school graduate, 5-college level, 6-college graduate), $EducStat_i$ is a dummy variable that refers to a youth members who are in-school youth (0-out of school youth, 1-in school youth), $Inf4Hmem$ is a dummy variable that refers to youth members who are influence by 4-H coordinator (0-No, 1-Yes), $Inffam_i$ is a dummy variable that refers to youth members who are influence by family (0-No, 1-Yes), $Training_i$ is a dummy variable that refers to youth members who attended training in vegetable technology (0-No, 1-Yes), $Complex_i$ refers to the rating (scale of 1 to 5) of youth members to the complexity of vegetable technology, $Econ_i$ refers to the rating (scale of 1 to 5) of youth members on how economically viable is the vegetable technology, $Compa_i$ refers to the rating (scale of 1 to 5) of youth members to the compatibility of vegetable technology, $Esafe_i$ refers to the rating (scale of 1 to 5) of youth members on how safe to the environment is the vegetable technology, $Minrisk_i$ refers to the rating (scale of 1 to 5) of youth members on how risky is the vegetable technology, $Credit_i$ is a dummy variable that refers to a youth members who have access to credit, $Effcoor_i$ refers to the rating (scale of 1 to 5) of youth members on how effective are the 4-H coordinator to their assigned task and $\varepsilon_i$represents to the remaining random error of model (1). Post-estimation techniques (diagnostics) were done to validate the statistical results and all computations were tested its significance.

RESULTS AND DISCUSSIONS

Demographic Profile

Table 4 below shows a demographic profile of the youth members under study. The age-wise distribution indicates that the majority fall within the 15-30 age range, comprising 83.90% of the sample, with a mean age of 20.78. This suggests a predominantly young demographic. In terms of gender, there is a nearly equal distribution, with 50.80% female and 49.20% male members. Educationally, the sample is diverse, ranging from elementary level to college graduates, with high school graduates forming the largest group (24.60%).

Table 4. Demographic profile of youth members

Profile	Category	n	%
Age	10-14	10	8.50
	15-30	99	83.90
	31-40	8	6.77
	41 and above	1	0.85
	Mean	20.78	
Sex	Female	60	50.80
	Male	58	49.20
Educational attainment	Elementary level	2	1.70
	Elementary graduate	2	1.70
	Highschool level	37	31.40
	Highschool graduate	29	24.60
	College level	33	28.00
	College Graduate	15	12.70
Educational status	In-School Youth	73	61.90
	Out-of-School Youth	45	38.10
Monthly Family Income (PHP)	3,000 below	7	5.93
	3,000 - 5,999	59	50.00
	6,000 - 8,999	27	22.90
	9,000 - 11,999	17	14.40
	12,000 - 14,999	3	2.50
	15,000 and above	5	4.23
	Mean	6,647.83	
Household size	2-4 members	17	14.40
	5-7 members	56	47.50
	8-10 members	42	35.60
	11-13 members	3	2.50
Credit Access	Yes	16	13.56
	No	102	86.44

Note: PHP-Philippine peso (0.0178 USD)
Source: Authors' computations (2024).

Regarding educational status, 61.90% are in-school youth, emphasizing the importance of education in this demographic. Monthly family income distribution illustrates a varied economic background, with the majority (50.00%) earning between PHP 3,000 and 5,999, while credit access is limited, with only 13.56% having access. The household size is relatively diverse, with the most common range being 5-7 members (47.50%). The demographic profile of the youth members provides valuable insights for crafting targeted interventions and strategies. The concentration of youth in the 15-30 age range suggests a dynamic group, offering opportunities for

initiatives aligned with their energy. Nearly equal gender distribution supports inclusive programs catering to diverse needs. Educational diversity, spanning from elementary to college graduates, hints at a varied skill set, allowing for multifaceted development initiatives [6],[46]. Emphasizing in-school youth reveals a platform for integrating agricultural education into formal learning. Varied economic backgrounds indicate the need for inclusive economic support, and limited credit access highlights potential financial challenges, prompting financial literacy programs [7], [18], [30]. Diverse household sizes stress the importance of considering family dynamics in effective interventions. These insights inform tailored programs for the youth in Southern Leyte, fostering sustainable agriculture and technology adoption.

Influence Profile

Table 5 outlines the profile of youth in the 4-H club, providing insights into their influences and participation. The overwhelming majority, 94.10%, report being influenced by other 4-H club members, indicating a strong peer influence within the club. Additionally, 77.97% acknowledge the influence of family members, highlighting the role of familial support in their engagement with the 4-H club. Furthermore, a significant proportion, also 77.97%, have attended training, emphasizing a commitment to skill development and knowledge enhancement among the youth in the 4-H club. These findings suggest a positive and supportive environment within the club, fostering peer connections, family involvement, and a dedication to learning and development through training opportunities. A noteworthy observation is the prevalent influence of fellow 4-H club members, with a significant majority acknowledging this peer impact. Moreover, a substantial proportion of youth in the 4-H club recognize the influence of their family members, emphasizing the supportive role of family in their involvement [42]. The data also reveals a significant commitment to learning and development, as a considerable percentage of youth have attended training sessions within the 4-H club. These insights underscore the importance of peer and family support, as well as the dedication of the youth to skill enhancement and knowledge acquisition through training opportunities within the club.

Table 5. Influence profile of youth in the 4-H club

Profile	Category	n	%
Influence from 4-H club members	Yes	111	94.10
	No	7	5.90
Influence from family members	Yes	92	77.97
	No	26	22.03
Attended Training	Yes	92	77.97
	No	26	22.03

Source: Author's computations (2024).

Vegetable Technology Characteristics

Table 6 presents the results of a rating assessment on various characteristics related to vegetable technology. The mean (M) and standard deviation (SD) values offer insights into the perceived attributes of these technologies among the respondents. The characteristic "Vegetable-Complexity" received a mean rating of 2.84 with a standard deviation of 0.73, indicating a neutral perception. "Vegetable-Economically viable" scored a mean of 3.59 with a standard deviation of 1.15, suggesting general agreement among respondents. On the contrary, "Vegetable-Compatibility" exhibited a mean of 1.76 with a standard deviation of 0.96, signaling a strong disagreement regarding its compatibility. "Vegetable-Environmentally safe" garnered a mean of 3.67 with a standard deviation of 1.17, reflecting an overall agreement. Lastly, "Vegetable-Minimal risk" obtained a mean of 2.74 and a standard deviation of 1.08, positioning it within a neutral range. The scale used for assessment ranges from 1 to 5. These ratings offer a quantitative measure of the perceived characteristics of vegetable technology, providing a basis for further analysis and interpretation. Notably, the characteristic "Vegetable complexity" is described as having a neutral perception, suggesting a middling level of complexity without specifying the exact rating. "Vegetable-Economically viable" is portrayed as generally agreeable among respondents, indicating a positive inclination towards the economic feasibility of vegetable technology [26], [35], [43]. Conversely, "Vegetable compatibility" is highlighted for its strong disagreement, emphasizing a perceived lack of

compatibility. "Vegetable-environmentally safe" is characterized by an overall agreement on its safety aspects. Lastly, "Vegetable-Minimal risk" is positioned within a neutral range, suggesting a mixed perception regarding the level of risk associated with vegetable technology.

Table 6. Rating of vegetable technology characteristics

Characteristics	M	SD	Description[b]
Vegetable-Complexity[a]	2.84	0.73	Neutral
Vegetable-Economically viable[a]	3.59	1.15	Agree
Vegetable-Compatibility[a]	1.76	0.96	Strongly disagree
Vegetable-Environmentally safe[a]	3.67	1.17	Agree
Vegetable-Minimal risk[a]	2.74	1.08	Neutral

Note: a - Scale of 1 to 5; b - See Table 1.
Source: Authors' computations (2024).

On average, the youth members' rating for the 4-H club coordinator is close to 4.55 (SD=0.64) which can be interpreted as highly effective (See Table 1). This indicates that the coordinator has assisted effectively the youth members in regard to technical capability with a sense of responsibility. Additionally, coordinators have provided clear instructions, effectively followed up on 4-H programs with youth members, and handled the problems effectively by providing solutions. It is evident in Fig. 2 that most of the youth members have rated the 4-H coordinator as 5 out of a 5-point rating scale which can be described as highly effective in their responsibilities. In [15], it is depicted that the 4-H club is doing its best to reach out to farmers in regard to new innovative technologies for the improvement of agricultural production and well-being.

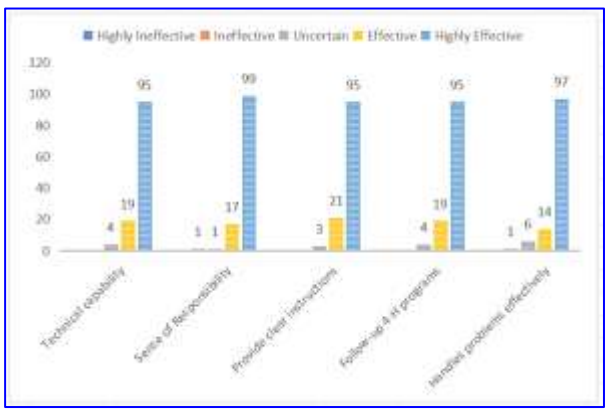

Fig. 2. Effectiveness level of 4-H coordinator.
Source: Authors' frequency construction (2024).

Stages of Adoption

Table 7 shows that most of the youth members of the 4-H club are aware, interested, and decided to implement vegetable technologies in their respective areas. However, during the survey, there are only a few of them are actually implementing and adopting the said vegetable technologies.

Table 7. Stages of adoption among youth members

Levels	Categories	n	%
Awareness	Not aware	4	3.39
	Slightly aware	58	49.15
	Aware	56	47.46
Interest	Not interested	13	11.02
	Slightly interested	31	26.27
	Interested	74	62.71
Decision	Rejected	12	10.17
	Moderately decided	40	33.90
	Decided	66	55.93
Implementation	Not implemented	88	74.58
	Slightly implemented	20	16.95
	Implemented	10	8.47
Adoption	Not adopted	109	92.37
	Slightly adopted	4	3.39
	Adopted	5	4.24

Source: Authors' computations (2024).

Ordered Logistic Models

The five (5) regression models as reflected in Tables 8 and 9 do not possess a multicollinearity problem considering that the computed variance inflation factor (VIF) does not exceed 10 and this indication is based on [3]. Table 8 shows the first three regression models representing the initial stages of vegetable technology adoption. These 3 models (Model 1 (Awareness): X^2=43.57, R^2=0.231; Model 2 (Interest): X^2=31.50, R^2=0.128; Model 3 (Decision): X^2=36.05, R^2=0.159) are significant at 1% level which indicates that there are significant factors affecting the initial stages of adoption. In model 1, it is shown that smaller household size (p-value<0.05) is a significant predictor of awareness of vegetable technology at a 5% level. This indicates that if a member does not have a lot of family responsibilities, they can be easily aware of the technology and be guided by the 4-H coordinator. Secondly, model 1 depicted that if a vegetable technology is less complex (p-value<0.05), youth members are more like aware of its characteristics. This implies that the awareness of the youth members increases if they can follow easily the procedure of the said technology. In [37], it is portrayed that if the

farmer can focus on agricultural training, they become aware of the various characteristics of the newly introduced technologies. Model 1 also depicted that youth members with no financial liability or debt (p-value<0.05) are more likely aware of the content of vegetable technologies. It is worth noting that if a member has no other responsibilities to other organizations, they can concentrate on acquiring knowledge in the agricultural training implemented by the 4-H club [32].

Model 2 revealed that if the vegetable technology is not complex (p-value<0.05) to follow, youth members are more likely interested. This shows that youth members are showing interest in the technology if they can easily understand the procedure of applying the said technology. Schemes in sustainable agriculture that are motivating processes an interesting and satisfying to learn for the better future [8], [14]. In model 3, it is portrayed that female members (p-value<0.05) are more likely to decide to apply the vegetable technology. Note that vegetable planting is not a masculine job wherein females are capable of doing the task of plant growing. Decision-making in the application of agricultural technology must suit to the interest and awareness of the characteristics and features [12]. Plus, Model 3 also depicted that if the technology is not complex (p-value<0.01) to follow, youth members have a higher likelihood to decide in applying the technology. In [25], doable innovations are ideal to obtain a progressive and sustainable agriculture in which an individual are more likely to apply for the quality of products and good marketability. Moreover, youth members are more likely to decide to apply vegetable technology if they have no credit access or financial debt (p-value<0.01) from other institutions. This means that they are willing to invest and take the risk for the technology if they do not have other money obligations.

In fact, investing in innovative technology requires more information and details to avoid risk and ensure a progressive adoption of the agricultural technology [30]. In addition, youth members need budget support in applying agricultural technology [46].

Table 8. Ordinal logistic models 1-3

Predictors	Dependent variables (1 to 3 scaling)		
	Model 1 (Awareness)	**Model 2 (Interest)**	**Model 3 (Decision)**
Age	0.136^{ns} (0.075)	0.001^{ns} (0.066)	0.037^{ns} (0.065)
Sex[a]	0.602^{ns} (0.430)	-0.426^{ns} (0.389)	-0.822* (0.407)
Educational attainment[b]	0.225^{ns} (0.231)	0.252^{ns} (0.196)	0.109^{ns} (0.223)
Educational status[a]	-0.557^{ns} (0.586)	0.341^{ns} (0.527)	0.114^{ns} (0.539)
Monthly Family Income (PHP)	<0.001^{ns} (0.0001)	<0.001^{ns} (0.0001)	<0.001^{ns} (0.0001)
Household size	-0.445* (0.129)	-0.044^{ns} (0.099)	-0.064^{ns} (0.109)
Influence from 4-H club members[a]	0.209^{ns} (0.981)	-0.904^{ns} (1.981)	0.621^{ns} (0.995)
Influence from family members[a]	0.500^{ns} (0.701)	-0.182^{ns} (0.508)	-0.447^{ns} (0.707)
Attended Training[a]	0.093^{ns} (0.613)	0.594^{ns} (0.694)	0.487^{ns} (0.592)
Vegetable-Complexity[c]	-1.481* (0.452)	-0.708* (0.316)	-1.039** (0.340)
Vegetable-Economically viable[c]	-0.005^{ns} (0.208)	0.088^{ns} (0.185)	0.262^{ns} (0.202)
Vegetable-Compatibility[c]	-0.126^{ns} (0.237)	0.059^{ns} (0.226)	-0.045^{ns} (0.228)
Vegetable-Environmentally safe[c]	-0.097^{ns} (0.219)	-0.025^{ns} (0.211)	-0.115^{ns} (0.208)
Vegetable-Minimal risk[c]	-0.078^{ns} (0.252)	0.111^{ns} (0.206)	0.114^{ns} (0.245)
Credit Access[a]	-3.348* (1.314)	-1.674^{ns} (0.889)	-3.108** (1.158)
Effectiveness of 4-H coordinator[c]	0.138^{ns} (0.408)	0.645^{ns} (0.405)	0.138^{ns} (0.387)
Participants	115	115	115
X^2-computed	43.57**	31.50**	36.05**
p-value (two-tailed)	<0.001	<0.001	<0.001
Pseudo R-squared	0.231	0.128	0.159

Note: a - dummy variable; b -(1-elementary level, 2-elementary graduate, 3-high school level, 4-high school graduate, 5-college level, 6-college graduate) c - 1 to 5 scaling; ns - not significant; *p<0.05; **p<0.01.
Source: Authors' computations (2024).

Model 4 showed that youth members with higher monthly income (p-value<0.1), are more likely to implement the vegetable technologies that they have learned from the 4-H club (Table 9). This means that youth members are willing to invest in the technology to produce quality vegetables if they have enough budget for the financial requirements of the agricultural program. In [13], in order to encourage the youth members to implement the technology, they must be supported by the local government in regard to the financial aspect and training activities. Additionally, Model 4 depicted that youth members are implementing the vegetable technologies if it is not complex (p-value<0.01) to follow the series of steps. This is also true in Model 5 with the same level of significance. Hence, it

indicates that youth members will adopt the technology if they have grasped the procedures and they can easily implement them in their respective areas. Nowadays, youth are more likely to adopt a technology if they can relate and it is easy for them to manipulate and the effects are favorable for them [23], [29]. Moreover, if the 4-H coordinators are effective in transferring the knowledge of the technology, then youth members are more likely to implement it. Youth farmers can adopt technologies if they have learned the pros and cons as well as the impact of the technology on their lives [15]. Lastly, youth members are going to implement the technology if they don't have financial debt and it is significant at a 1% level.

Table 9. Ordinal logistic models 4 and 5

Predictors	**Dependent variables (1 to 3 scaling)**	
	Model 4 (Implementation)	**Model 5 (Adoption)**
Age	0.098^{ns} (0.061)	0.136^{ns} (0.101)
Sex[a]	-0.497^{ns} (0.433)	-0.008^{ns} (0.449)
Educational attainment[b]	0.029^{ns} (0.246)	-0.283^{ns} (0.355)
Educational status[a]	-0.243^{ns} (0.509)	-0.256^{ns} (0.561)
Monthly Family Income (PHP)	<0.001* (<0.001)	<0.001^{ns} (0.0001)
Household size	-0.122^{ns} (0.109)	-0.223^{ns} (0.121)
Influence from 4-H club members[a]	0.629^{ns} (0.889)	0.026^{ns} (0.991)
Influence from family members[a]	-0.025^{ns} (0.597)	0.311^{ns} (0.838)
Attended Training[a]	-0.055^{ns} (0.505)	-0.192^{ns} (0.586)
Vegetable-Complexity[c]	-1.028** (0.372)	-0.986** (0.368)
Vegetable-Economically viable[c]	0.031^{ns} (0.232)	0.2186^{ns} (0.206)
Vegetable-Compatibility[c]	-0.009^{ns} (0.251)	-0.089^{ns} (0.238)
Vegetable-Environmentally safe[c]	-0.092^{ns} (0.213)	-0.178^{ns} (0.229)
Vegetable-Minimal risk[c]	0.036^{ns} (0.183)	0.043^{ns} (0.255)
Credit Access[a]	-4.362** (1.458)	-5.649^{ns} (3.136)
Effectiveness of 4-H coordinator[c]	0.714* (0.309)	0.373^{ns} (0.415)
Participants	115	115
X^2-computed	43.41**	19.87^{ns}
p-value (two-tailed)	<0.001	0.226
Pseudo R-squared	0.172	0.184

Note: a - dummy variable; b -(1-elementary level, 2-elementary graduate, 3-high school level, 4-high school graduate, 5-college level, 6-college graduate) c - 1 to 5 scaling; ns - not significant; *p<0.1; **p<0.01.
Source: Authors' computations (2024).

This implies that the technology requires a budget aspect and youth members are not able to focus on investing if they have other financial responsibilities. In that case, youth members must be supported by the government for their lack of funds to implement the vegetable technology [21], [24].

CONCLUSIONS

In this research endeavor, the primary focus revolves around clarifying the extent of adoption of vegetable technologies within the demographic of youth affiliated with the 4-H club in specific regions of Southern Leyte, Philippines. The results revealed that during the conduct of the survey, there are only a few youth members are implementing and adopting vegetable technologies. It is revealed that youth members are more like to implement the vegetable technology if they have a higher income and if they do not have financial problems. Additionally, it is depicted that youth members are going to implement and adopt the technology if it is not complex to follow and they are guided by an expert 4-H coordinator. Hence, the study strongly suggests that the local government must support the youth members in regard to financial aid in implementing the vegetable technology. Moreover, the Department of Agriculture (DA) must send more agricultural extension agents to guide the youth farmers in implementing and adopting vegetable technologies in their respective areas. Hence, this study endeavors to contribute valuable insights into the predictors that shape the decisions and behaviors of policy-making bodies in embracing agricultural innovations. For future research, one must undertake a differentiated understanding of the intersection between the youth, 4-H club dynamics, and vegetable technology adoption that paves the way for informed strategies and interventions in the realm of sustainable agriculture.

REFERENCES

[1]Aderibigbe, O.R., Ezekiel, O.O., Owolade, S. O., Korese, J.K., Sturm, B., Hensel, O., 2022, Exploring the potentials of underutilized grain amaranth (*Amaranthus* spp.) along the value chain for food and nutrition

security: A review. Critical reviews in food science and nutrition, 62(3): 656-669. https://doi.org/10.1080/10408398.2020.1825323, Accessed on February 1, 2024.
[2]Agans, J. P., Maley, M., Rainone, N., Cope, M., Turner, A., Eckenrode, J., Pillemer, K., 2020, Evaluating the evidence for youth outcomes in 4-H: A scoping review. Children and Youth Services Review, 108: 104617. https://doi.org/10.1016/j.childyouth.2019.104617, Accessed on February 11, 2024.
[3]Allison, P.D., 2012, Logistic regression using SAS: Theory and application. SAS Institute. https://mycourses.aalto.fi/pluginfile.php/889996/mod_resource/content/2/Paul%20D.%20Allison%20-%20Logistic%20Regression%20Using%20SAS%20-%20Ch%202.pdf, Accessed on October 1, 2022.
[4]Anderson, B.L., 2019, Impacts of the state 4-H Council experience: a phenomenological study (Doctoral dissertation, University of Missouri--Columbia).https://mospace.umsystem.edu/xmlui/handle/10355/69927, Accessed on February 12, 2024.
[5]Anderson, B., 2021, Impacts of State 4-H Council Service: A Phenomenological Study. Journal of Human Sciences and Extension, 9(3): 1. https://doi.org/10.54718/CETC2284, Accessed on February 10, 2024.
[6]Andrews, C., Montesquiou, A. de, Sánchez, I.A., Dutta, P.V., Samaranayake, S., Heisey, J., Clay, T., Chaudhary, S., 2021, The State of Economic Inclusion Report 2021: The Potential to Scale. In Google Books. World Bank Publications. https://econpapers.repec.org/bookchap/wbkwbpubs/34917.htm, Accessed on February 15, 2024.
[7]Arias, O., Evans, D. K., Santos, I., 2019, The Skills Balancing Act in Sub-Saharan Africa: Investing in Skills for Productivity, Inclusivity, and Adaptability. In Google Books. World Bank Publications. https://policycommons.net/artifacts/1286108/the-skills-balancing-act-in-sub-saharan-africa/1883972/, Accessed on February 19, 2024.
[8]Arnold, M. E., 2018, From context to outcomes: A thriving model for 4-H youth development programs. Journal of Human Sciences and Extension, 6(1): 11.https://doi.org/10.54718/nbnl5438, Accessed on February 1, 2024.
[9]Barber, T. M., Kabisch, S., Pfeiffer, A. F. H., Weickert, M. O., 2020, The Health Benefits of Dietary Fibre. Nutrients, 12(10): 3209. https://doi.org/10.3390/nu12103209, Accessed on February 2, 2024.
[10]Buchan, M. C., Bhawra, J., Katapally, T.R., 2024, Navigating the digital world: development of an evidence-based digital literacy program and assessment tool for youth. Smart Learning Environments, 11(1): 1-24. https://doi.org/10.1186/s40561-024-00293-x, Accessed on February 5, 2024.
[11]Burrow, A. L., Ratner, K., Porcelli, S., Sumner, R., 2020, Does Purpose Grow Here? Exploring 4-H as a Context for Cultivating Youth Purpose. Journal of Adolescent Research, 37(4): 471-500. https://doi.org/10.1177/0743558420942477, Accessed on February 19, 2024.
[12]Bush, S., Elliott-Engel, J., Wiley, S., Price, T. T., 2022, A Youth Perspective: The 4-H Teen's Leadership Identity Development Journey. Journal of Human Sciences and Extension, 10(1): 1. https://doi.org/10.54718/illa6686, Accessed on February 4, 2024.
[13]Casinillo, L. F., Clava, C. A., Bales, M. C., 2024, Modeling the Adoption of Aquaculture Technologies among the Members of 4-H Club Youth. Canadian Journal of Family and Youth/Le Journal Canadien de Famille et de la Jeunesse, 16(1): 1-15.https://doi.org/10.29173/cjfy29978, Accessed on February 14, 2024.
[14]Castiblanco Jimenez, I. A., Cepeda García, L. C., Marcolin, F., Violante, M. G., Vezzetti, E., 2021, Validation of a TAM Extension in Agriculture: Exploring the Determinants of Acceptance of an e-Learning Platform. Applied Sciences, 11(10): 4672. https://doi.org/10.3390/app11104672, Accessed on February 1, 2024.
[15]Clava, C.A., Bales, M.C., Casinillo, L.F., Yap, K.L. P., Cadenas, J.M., 2023, Modeling the factors of implementation and adoption of rice technology among 4-H club youth. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 23(3): 157-164. https://managementjournal.usamv.ro/pdf/vol.23_3/volume_23_3_2023.pdf, Accessed on February 14, 2024.
[16]Elliott-Engel, J., 2021, The Great Eight: Arizona 4-H Pathways of Participation for Thriving. CALS Cooperative Extension Publications. The University of Arizona. https://repository.arizona.edu/handle/10150/670032, Accessed on February 9, 2024.
[17]Elliott-Engel, J., Westfall-Rudd, D. M., Seibel, M., Kaufman, E., Radhakrishna, R., 2024, Administrators' perspectives on organizational environmental factors facing 4-H youth development. Children and Youth Services Review, 156: 107358. https://doi.org/10.1016/j.childyouth.2023.107358, Accessed on February 1, 2024.
[18]Ganon-Shilon, S., Finkelstein, I., Sela-Shayovitz, R., Schechter, C., 2022, Inclusive Leadership in Times of COVID-19 Crisis: The Role of District and School Leaders in Fostering School Sense-Making Processes within a National Inclusion and Integration Reform. Leadership and Policy in Schools, 22(4): 992-1012. https://doi.org/10.1080/15700763.2022.2052907, Accessed on February 22, 2024.
[19]Google Earth, 2024, Region VIII, Southern Leyte, Philippines. https://www.google.com/maps/place/Southern+Leyte, Accessed on February 21, 2024.
[20]Hauge, C., Rowsell, J., 2020, Child and youth engagement: civic literacies and digital ecologies. Discourse: Studies in the Cultural Politics of Education, 41(5): 667-672. https://doi.org/10.1080/01596306.2020.1769933, Accessed on February 1, 2024.

[21]Hoang, H. G., 2020, Exploring farmers' adoption of VietGAP from systemic perspective: implication for developing agri-food systems. British Food Journal, 122(22): 3641-3661. https://doi.org/10.1108/bfj-09-2019-0724, Accessed on February 7, 2024.
[22]Hunter, D., Borelli, T., Beltrame, D.M.O., Oliveira, C.N.S., Coradin, L., Wasike, V. W., Wasilwa, L., Mwai, J., Manjella, A., Samarasinghe, G. W. L., Madhujith, T., Nadeeshani, H.V.H., Tan, A., Ay, S.T., Güzelsoy, N., Lauridsen, N., Gee, E., Tartanac, F., 2019, The potential of neglected and underutilized species for improving diets and nutrition. Planta, 250(3): 709–729. https://doi.org/10.1007/s00425-019-03169-4, Accessed on February 15, 2024.
[23]Jorasch, P., 2019, The global need for plant breeding innovation. Transgenic Research, 28(S2): 81–86. https://doi.org/10.1007/s11248-019-00138-1, Accessed on February 1, 2024.
[24]Kalia, A., Kaur, H., 2019, Nano-biofertilizers: Harnessing Dual Benefits of Nano-nutrient and Bio-fertilizers for Enhanced Nutrient Use Efficiency and Sustainable Productivity. Springer EBooks, 51–73. https://doi.org/10.1007/978-3-319-97852-9_3, Accessed on February 5, 2024.
[25]Karunathilake, E.M.B.M., Le, A.T., Heo, S., Chung, Y.S., Mansoor, S., 2023, The Path to Smart Farming: Innovations and Opportunities in Precision Agriculture. Agriculture, 13(8): 1593. https://doi.org/10.3390/agriculture13081593, Accessed on February 1, 2024.
[26]Laibach, N., Börner, J., Bröring, S., 2019, Exploring the future of the bioeconomy: An expert-based scoping study examining key enabling technology fields with potential to foster the transition toward a bio-based economy. Technology in Society, 58: 101118. https://doi.org/10.1016/j.techsoc.2019.03.001, Accessed on February 4, 2024.
[27]Lile, J.R., Weybright, E.H., Watson, P., 2021, Using the 4-H Essential Elements to Evaluate Teen Programming. Journal of Youth Development, 16(1): 55–73. https://doi.org/10.5195/jyd.2021.906, Accessed on February 1, 2024.
[28]Mahalanobis, P. C., 1950, Cost and accuracy of results in sampling and complete enumeration. http://library.isical.ac.in:8080/jspui/bitstream/10263/2000/1/243.pdf, Accessed on February 14, 2024.
[29]Mittal, R. K., Mishra, R., Sharma, V., Purohit, P., 2024, Bioactive Exploration in Functional Foods: Unlocking Nature's Treasures. Www.ingentaconnect.com. https://www.ingentaconnect.com/content/ben/cpb/pre-prints/content-bms-cpb-2023-363, Accessed on February 22, 2024.
[30]Murray, K. A., Trexler, C. J., Cannon, C. E. B., 2020, Queering Agricultural Education Research: Challenges and Strategies for Advancing Inclusion. Journal of Agricultural Education, 61(4): 296–316. https://eric.ed.gov/?id=EJ1281300,Accessed on February 23, 2024.
[31]Mzara, O., 2019, Changing youth perceptions: exploring enablers of diffusion and adoption of agricultural innovations in South Africa. Repository.up.ac.za. https://repository.up.ac.za/handle/2263/71737, Accessed on February 1, 2024.
[32]Nakano, Y., Tsusaka, T.W., Aida, T., Pede, V.O. 2018, Is farmer-to-farmer extension effective? The impact of training on technology adoption and rice farming productivity in Tanzania. World Development, 105: 336-351. https://doi.org/10.1016/j.worlddev.2017.12.013, Accessed on June 23, 2023.
[33]Paceley, M. S., Okrey-Anderson, S., Fish, J. N., McInroy, L., Lin, M., 2020, Beyond a shared experience: Queer and trans youth navigating COVID-19. Qualitative Social Work, 147332502097332. https://doi.org/10.1177/1473325020973329, Accessed on February 1, 2024.
[34]Palis, F.G., 2006, The role of culture in farmer learning and technology adoption: a case study of farmer field schools among rice farmers in central Luzon, Philippines. Agriculture and Human Values, 23: 491-500. https://link.springer.com/article/10.1007/s10460-006-9012-6, Accessed on April 20, 2023.
[35]Pascaris, A. S., Schelly, C., Burnham, L., Pearce, J. M., 2021, Integrating solar energy with agriculture: Industry perspectives on the market, community, and socio-political dimensions of agrivoltaics. Energy Research & Social Science, 75: 102023. https://doi.org/10.1016/j.erss.2021.102023, Accessed on February 10, 2024
[36]Ragaveena, S., Shirly Edward, A., & Surendran, U., 2021, Smart controlled environment agriculture methods: a holistic review. Reviews in Environmental Science and Bio/Technology, 20(4): 887–913. https://doi.org/10.1007/s11157-021-09591-z, Accessed on February 17, 2024.
[37]Red, F.S., Amestoso, N.T., Casinillo, L.F., 2021, Effect of Farmer Field School (FFS) on the Knowledge, Attitude, Practices and Profitability of Rice Farmers. Philippine Social Science Journal, 4(4): 145-154. https://doi.org/10.52006/main.v4i4.420, Accessed on February 19, 2024.
[38]Rogers, E.M., 2003, Diffusion networks. Networks in the knowledge economy, 130-179.https://scholar.google.com/ Accessed on February 5, 2024.
[39]Sambo, P., Nicoletto, C., Giro, A., Pii, Y., Valentinuzzi, F., Mimmo, T., Lugli, P., Orzes, G., Mazzetto, F., Astolfi, S., Terzano, R., Cesco, S., 2019, Hydroponic Solutions for Soilless Production Systems: Issues and Opportunities in a Smart Agriculture Perspective. Frontiers in Plant Science, 10: 923. https://doi.org/10.3389/fpls.2019.00923, Accessed on February 12, 2024.
[40]Saras, T., 2023, Unlocking the Power of Vitamins: A Comprehensive Guide to Optimal Health. In Google Books. Tiram Media. https://books.google.com.ph/books?hl=en&lr=&id=nTjnEAAAQBAJ&oi=fnd&pg=PA1&dq=Unlocking+Wellness:+The+Multifaceted+Benefits+of+Diverse+Vegetable+Consumption&ots=XaICqs0EKI&sig=9HRDQQ

bmLTlY3mOR_bgjdgot-JU&redir_esc=y, Accessed on February 12, 2024.
[41]Shang, L., Heckelei, T., Gerullis, M.K., Börner, J., Rasch, S., 2021, Adoption and diffusion of digital farming technologies-integrating farm-level evidence and system interaction. Agricultural systems, 190: 103074.https://doi.org/10.1016/j.agsy.2021.103074, Accessed on June 23, 2023.
[42]Smith, M. Jr., Webster, N., Nayak, R., 2022, Exploring African American Male Youth's Perceptions of Community Involvement Through 4-H Programs. Journal of Youth Development, 17(1): 9–32. https://doi.org/10.5195/jyd.2022.953, Accessed on February 21, 2024.
[43]Specht, K., Zoll, F., Schümann, H., Bela, J., Kachel, J., Robischon, M., 2019, How Will We Eat and Produce in the Cities of the Future? From Edible Insects to Vertical Farming—A Study on the Perception and Acceptability of New Approaches. Sustainability, 11(16): 4315. https://doi.org/10.3390/su11164315, Accessed on February 13, 2024.
[44]Ulian, T., Diazgranados, M., Pironon, S., Padulosi, S., Liu, U., Davies, L., Howes, M.R., Borrell, J.S., Ondo, I., Pérez-Escobar, O.A., Sharrock, S., Ryan, P., Hunter, D., Lee, M. A., Barstow, C., Łuczaj, Ł., Pieroni, A., Cámara-Leret, R., Noorani, A., Mba, C., 2020, Unlocking plant resources to support food security and promote sustainable agriculture. PLANTS, PEOPLE, PLANET, 2(5): 421–445. https://doi.org/10.1002/ppp3.10145, Accessed on February 15, 2024.
[45]Vettern, R., Flage, L., 2018, Assessing Results of 4-H Mentoring with Native American First-Generation 4-H Youths. The Journal of Extension, 56(3). https://doi.org/10.34068/joe.56.03.22, Accessed on February 12, 2024.
[46]Zulu, L. C., Djenontin, I. N. S., Grabowski, P., 2021, From diagnosis to action: Understanding youth strengths and hurdles and using decision-making tools to foster youth-inclusive sustainable agriculture intensification. Journal of Rural Studies, 82: 196–209. https://doi.org/10.1016/j.jrurstud.2021.01.023, Accessed on February 16, 2024.