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Factors Influencing the Adaptation to Fully Organic Vegetable Farming: A Farmer Perception Study in Polonnaruwa District, Sri Lanka

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ABSTRACT

In recent times, the Sri Lankan government's agricultural policy has shifted rapidly from inorganic to organic farming. As a result, organic farming has become a debatable and timely valuable topic in Sri Lanka. Organic farming is an agricultural farming method that applies environmentally friendly pest and weed control mechanisms and fertilizers derived primarily from animal and plant wastes, as well as nitrogen-fixing cover crops. This study focused on analysing how farmers' general attitudes, behavioural beliefs, favourable attitudes toward fully organic farming, subjective norms, and perceived behavioural control influence the adaptation to fully organic vegetable farming in Polonnaruwa district. A questionnaire survey was conducted by face-to-face interviews to gather primary data from a randomly selected sample of 300 farmers from the vegetable sector in the Polonnaruwa district. The data were analysed using Confirmatory Factor Analysis through AMOS in the SPSS 24 version. The results revealed that the farmers' perceptions of the adaptation to fully organic vegetable farming are significantly and negatively influenced by general attitudes, behavioural beliefs, favourable attitudes towards fully organic farming, subjective norms, and perceived behavioural control among farmers in the Polonnaruwa district. Findings are important for policymakers and relevant organizations when implementing the agriculture policy in the country.

Keywords: Adaptation to fully organic, Polonnaruwa district, Vegetable farming.

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INTRODUCTION

Organic agriculture is gaining significant attention globally, as evidenced by the growing popularity of this sustainable farming approach (Willer and Lernoud, 2019). The International Federation of Organic Agriculture Movements defines organic agriculture as a production system that prioritizes the health of

soils, ecosystems, and people, relying on ecological processes, biodiversity, and local adaptations instead of potentially harmful inputs (IFOAM, 2021). Over the past decade, the worldwide trend in organic agriculture has been positive, with notable increases in the USA and Canada's organic food markets by 20% each and in Europe by 7.8% annually (European Commission, 2019; Lapple and Kelley, 2010). Remarkably, Australia boasts the largest organic area, spanning approximately 35.6 million hectares, while Europe manages around 12.6 million hectares of organically cultivated farmland (Paull and Hennig, 2018; European Commission, 2019). Within this global context, Sri Lanka emerges as a noteworthy participant in the organic agriculture movement.

In Sri Lanka, a significant proportion of the agricultural sector relies on chemical inputs, with fertilizers, pesticides, and regulators widely used to meet the demand for food quantity over quality. To address this, Sri Lankan government has imposed a nationwide ban on the importation and use of synthetic fertilizers and pesticides, urging farmers to switch to organic farming, citing concerns about chronic diseases as justification (Dionglay, 2022). Although the world market for organic products has been expanding (Schlatter *et al*., 2019), mixed opinions are received from agriculture-related stakeholders regarding the sudden implementation of fully organic-based agriculture.

The adaptation of organic vegetable farming reflects a global trend towards sustainable agricultural practices. According to the literature, several factors influence the adaptation of organic farming. Demographic factors have been found to significantly influence the adaptation of organic farming practices. Several studies have examined the role of various socio-demographic factors in adapting to organic farming, including age, farming experience, ethnicity, educational level, and marital status (Azam and Banumathi, 2015; Azam, 2015). For example, farming experience has been shown to play a significant role in the adaptation of organic agriculture, with more experienced farmers being more likely to adapt organic farming practices (UME *et al*., 2023).

Attitudes also play a significant role in influencing the adaptation of organic farming, serving as critical

determinants that guide human behavior (Cherian *et al*., 2021). Research by Chang *et al*. (2023) underscores the impact of attitudes on the adaptation of organic practices. Farmers' information gathering and attitudes are crucial factors influencing their decisions regarding organic farming.

Subjective norms constitute another influential factor affecting the adaptation of organic farming (Tran and Tiet, 2022). Subjective norms refer to an individual's (such family members, friends, colleagues, and reference groups) perception of the social pressures and expectations from others concerning a specific behavior (Ham *et al*., 2015). These norms are influenced by the views, attitudes, and actions of subjective norms. When individuals sense that those within their social circle hold a positive attitude or inclination towards a behavior, they are more likely to be influenced. A study conducted by Jiumpanyarach (2021), highlights that subjective norms influence farmers' behaviour towards organic agriculture. However, negative subjective norms may be prevalent, particularly among small and medium-sized farmers (Xu *et al*., 2020). Farmers who strongly adhere to the opinions of subjective norms, may be reluctant to explore alternative production methods, which can limit their consideration of other potential options for their farms (Xu *et al*., 2020).

Perceived behavioural control is another factor that can influence the adaptation to organic farming. It refers to an individual's perception of the ability to perform a specific behaviour, such as adapting to organic farming practices. Research has shown that perceived behavioural control can significantly impact the intention to perform a given behaviour, such as the adaptation of organic farming practices (Yanakittkul and Aungvaravong, 2020).

Furthermore, behavioural beliefs of farmers significantly impact the adaptation to organic farming. Research indicates that farmers perceive the shift to organic farming as a strategy to enhance adaptation capacity by reducing risks, stimulating learning, increasing professional satisfaction, and maintaining family farms (Pinthukas, 2015). The perception of organic farming as less risky, attributed to higher and more stable prices, as well as increased feed autonomy, contributes to the reduced farm exposure to risks (Pinthukas, 2015). According to a previous study,

organic agriculture has recorded a lower environmental impact than conventional agriculture (Mishra *et al*., 2019). When compared to high-input conventional systems, organic agriculture uses fewer external inputs and, hence, emits fewer greenhouse gases per unit of land (Tuomisto *et al*., 2012). Bouttes *et al*. (2019) conclude that organic farming enhances the adaptive capacity of farmers, which is crucial for the long-term persistence of a farm.

However, it is noted in the literature that organic farming is found to be labor-intensive (Durham and Mizik, 2021). Despite potential benefits, challenges exist, with organic yields approximately 25% lower than inorganic-based farming yields (Seufert *et al*., 2012). However, specific studies on crops, such as organic tea in China and Sri Lanka, suggest that organic production can be more profitable than conventional methods (Qiao *et al*., 2016). In a recent study (Karalliyadda and Kazunari, 2020), it was mentioned that organic farming improves soil quality and soil sustainability.

Hence, studying influential factors in the adaptation of organic vegetable farming is of paramount importance, as it addresses critical aspects of environmental sustainability, consumer health, economic viability for farmers, market dynamics, policy development, and global food security. However, sufficient research has not been conducted in Sri Lanka on the factors influencing the farmer's adaptation to organic vegetable farming sufficiently, especially after the government policy shifted in a recent period from motivation to demotivation of inorganic farming. Due to existing knowledge gap, it is beneficial to conduct research to understand the influential factors in farmer adaptation to organic vegetable farming in Sri Lanka. Therefore, this study was focused on examining how demographic factors, farmers' general attitudes towards organic farming, behavioral beliefs, attitudes toward fully organic farming, subjective norms, and perceived behavioral control influence the adaptation to fully organic vegetable farming among farmers in Polonnaruwa district. Findings are important for policymakers, and agriculture sector organizations when implementing organic agriculture practices in the country.

MATERIALS AND METHODS

Conceptual Framework

Based on the selected variables, the following conceptual framework was proposed (Figure 1). Accordingly, the following hypotheses were formulated for the study.

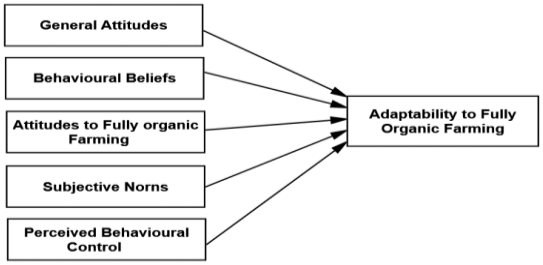

Figure 1. Conceptual framework.

H1: General attitudes towards organic influence full adaptability to organic vegetable farming.
H2: Behavioural beliefs influence full adaptability to organic vegetable farming.
H3: Favourable attitudes towards full organic farming influence adaptability to fully organic vegetable farming.
H4: Subjective norms influence adaptability to full organic vegetable farming.
H5: Perceived behavioural control influences adaptability to full organic vegetable farming.

Data Collection

Data were collected through face-to-face interviews using a structured questionnaire. A preliminary questionnaire was administered to a sample of twenty potential vegetable farmers to conduct the pre-test. Minor adjustments and modifications were made to the questionnaire based on the feedback received during this pre-testing phase. The sample size was 300 vegetable farmers from the Polonnaruwa district, covering randomly selected twelve Grama Niladari (GN) divisions from randomly selected three Divisional Secretariats (DS), i.e., Thamankaduwa, Higurakgoda, and Elahara. The sample size for the study was determined using the Cochran Formula (Cochran, 1963) with a 95% confidence level and a 5% margin of error. Respondents were selected based on simple random sampling through the list of vegetable farmers from each GN division.

Measures

The questionnaire comprised six sections, including demographic factors, general attitudes towards organic vegetable farming, behavioural

Table 1. Likert scale items used to measure the adaptability to fully organic vegetable farming.

Factor	Indicator name	Likert scale indicators
General Attitudes (GA)	GA1	Local markets are available for organic vegetables
	GA2	Use of chemical inputs is harmful to the health of people and animals
	GA3	Organic farming is labor-intensive
	GA4	Without using chemical pesticides, high pest infestation can happen
	GA5	Governmental support for organic farming is important
	GA6	Local consumers would be willing to pay higher prices for organic products
	GA7	Organic fertilizers and pesticides are available
	GA8	Conversion into organic farming requires high investment costs
	GA9	Organic farming requires high certification and inspection costs
	GA10	Organic farming reduces chemical output to the environment
	GA11	Organic products are healthier for people
	GA12	It is hard to find wholesale buyers who pay higher prices for organic products
Behavioural Beliefs (BB)	BB1	If you produce organic vegetable you will save on production costs (mainly fertilizer and pesticide costs)
	BB2	If you produce organic vegetable, you will receive higher prices
	BB3	If you produce organic vegetable, you will increase farm income
	BB4	If you produce organic vegetable, you will get opportunities to reach global markets
	BB5	Producing organic vegetables on your farm will provide healthy food for your family
	BB6	Producing organic vegetable on your farm can improve soil fertility

	BB7	Producing organic vegetable on your farm will protect the environment
	BB8	Producing organic vegetable on your farm will provide healthy food for your village
Favourable Attitude towards fully organic vegetable farming (AS)	AS1	Producing organic vegetables on your farm within the next five years would be a good idea
	AS2	Producing organic vegetables on your farm within the next five years would be possible
	AS3	Producing organic vegetables on your farm within the next five years would be more profitable than the conventional farming
Subjective Norms (SN)	SN1	Your family is motivated to organic farming
	SN2	Other farmers (fellow farmers) motivate organic farming
	SN3	Governmental support programs motivate organic farming
	SN4	Farm advisors motivate organic farming
Perceived Behavioural control (PBC)	PBC1	You think that you have technical ability to produce organic vegetable on your farm within the next five years
	PBC2	You think that you are mentally capable of dealing with organic farming on your farm within the next five years
	PBC3	You think that you can meet the regulations of organic farming on your farm within the next five years
	PBC4	You think that you can afford the costs of conversion to organic farming on your farm within the next five years
	PBC5	You think you can afford number of workers for organic farming
Adaptability for Fully Organic Vegetable Farming (AOV)	AOV1	You are willing to change to fully organic farming as soon as possible
	AOV2	You have ability to take risk to move fully organic farming in the future

beliefs, attitudes towards fully organic farming, subjective norms, and perceived behavioural control. Other than the demographic factors, 33 indicators were used to evaluate these factors. All indicators were assessed on a 5-point Likert-type scale, ranging from 1 to 5, where 1 was denoted "strongly disagree" and 5 was denoted "strongly agree." Table 1 provides a summary of all the indicators categorized under each factor.

Data Analysis

Descriptive statistics were used to analyse the demographic factors in the study population. Cronbach's Alpha Reliability Coefficient was used to evaluate the reliability of each factor used in the questionnaire. Confirmatory Factor Analysis (CFA) was employed to evaluate the validity of the measurement model. To examine the proposed model, Structural Equation Modelling (SEM) was employed, through the Analysis of Moment Structure (AMOS) in the SPSS 24 version. The estimates were based on the maximum likelihood estimation technique.

RESULTS AND DISCUSSION

Descriptive Statistics of the Sample

The majority of the respondents were male (61%), and 39% were women in the studied population (Table 2). The population contained 19%, 19%, 40%, and 22% in the age groups of 18-30, 31-40, 41-50, and above 50, respectively. Among the respondents, 18.33% had primary education, while others had above that level. The majority of the sample was at the secondary level of education (66.6%). Among the population, 53.34% had less than 5 years of experience in organic farming, 29.33% had 5-10 years of experience in organic farming, and 15.33% had more than 10 years of experience in organic farming.

Sampling Adequacy

To verify the factorability of the data, the Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity (BTS) were conducted. The KMO test evaluates whether the data are suitable for factor analysis, with a recommended threshold value of at least 0.60. Additionally, the BTS assesses the significance of the correlation matrix, with a threshold of $p < 0.1$. The results of

Table 2. Demographic factors of the sample.

Parameter	Category	Percentage (%)
Gender	Female	39
	Male	61
Age	18-30 years	19
	31-40 years	19
	41-50 years	40
	Above 50 years	22
Farmers' current household size	2	12
	3	10
	4	21.66
	5	37.33
	More than 5	19
Experience in Organic farming	Less than 5 years	53.34
	5-10 years	29.33
	More than 10 years	15.33
Educational Level	Primary education from grade 1 to 8	18.33
	Secondary education of O/L and A/L	66.66
	Diploma	7
	Bachelor's degree	7
	Others	1

both tests, as shown in Table 3, met the minimum requirements, indicating that the data were suitable for further factor analysis.

Reliability Statistics

Cronbach's Alpha was employed to assess internal consistency, with a threshold of 0.7 indicating acceptability (Hair *et al*., 1998). According to Table 4, all factors exhibited internal consistency above this threshold, signifying acceptable consistency within their indicators.

Confirmatory Factor Analysis (CFA)

The model initially used 34 indicators covering 7 factors, all of which exhibited sufficient fit. Table 5 presents the estimated results, indicating that all standardized estimates are statistically significant except for GA4, BB4, SN4,

Table 3. KMO and Bartlett's test.

Test	Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.831
Bartlett's Test of Sphericity Approx. Chi-Square	101119.049
df	1196
Probability	0.000

Table 4. Cronbach's Alpha of each factor.

Factors	Cronbach's Alpha	Indicators
General Attitudes	0.794	12
Behavioural Beliefs	0.799	8
Favourable Attitude Statements	0.806	3
Subjective Norms	0.759	4
Perceived Behavioural Control	0.768	5
Adaptability for Organic Vegetable Farming	0.824	2

PBC1, and PBC5 indicator variables. Among the remaining indicators, the GA5 indicator has the highest factor loading (0.92) towards general attitudes, indicating that the statement of governmental support for organic farming is important. It means that farmers believe government support is essential to converting to organic vegetable farming in the study population. The BB5 indicator shows the highest contribution (0.94) towards the factor of behavioural beliefs, indicating that the statement of producing organic vegetables will provide healthy food for the family. It means that farmers believe organic farming provides health benefits. The AS1 indicator had the highest factor loading (0.80) towards favourable attitudes, indicating that the statement of producing organic vegetables on the farm within the next five years would be a good idea. Farmers in the study population believe that converting to organic cultivation is beneficial. The SN3 indicator was the most influential indicator (0.91) towards subjective norms, which indicates the statement that governmental support programs motivate organic farming. It highlights that government support is essential to

converting study population to organic farming. The PBC1 indicator shows the highest contribution (0.92) towards perceived behavioural control (PBC), indicating the statement of having technical ability to produce organic vegetables on the farm within the next five years.

The Standardized Regression Weight analysis, as presented in Table 6, indicates that the adaptation to organic vegetable farming is significantly and negatively influenced by general attitudes, behavioural beliefs, favourable attitude towards fully organic vegetable farming, subjective norms, and perceived behavioural control of farmers in the Polonnaruwa district. Within the category of general attitudes toward adaptation to organic vegetable farming, there were twelve indicators, including the availability of local markets for organic vegetables, the detrimental effects of chemical inputs on human and animal health, concerning about the labour intensity of organic farming, the potential for high pest infestations without chemical pesticides, the importance of governmental support for organic farming, the willingness of local consumers to pay higher prices for organic products, the accessibility of organic fertilizers and pesticides, the high investment costs associated with converting to organic farming, the expenses related to certification and

Table 5. Confirmatory factor analysis results.

Factor	Estimate
General Attitudes Towards Organic Farming (GA)	
GA1 (Availability of local market for organic products)	0.85***
GA2 (Use of chemicals is negative for health)	0.83***
GA3 (Organic farming is labour intensity)	0.72***
GA4 (High pest attacks are there if pesticides are not used)	0.85
GA5 (Government's support)	0.93***
GA6 (Intention of local customers to pay higher than non-organic)	0.92***
GA7 (Availability of organic fertilizers and pesticide)	0.85***
GA8 (Investment cost is higher when converting to organic)	0.84
GA9 (Certification cost is high in organic farming)	0.76***
GA10 (Organic farming reduce chemical release to the environment)	0.91***

GA11 (Organic products are healthier)	0.74***
GA12 (Finding wholesale buyers is difficult who can pay high)	0.84***
Behavioural Beliefs on Organic Farming (BB)	
BB1 (Organic farming save the production cost)	0.68***
BB2 (Receive high income from organic farming)	0.90***
BB3 (Organic farming increases farm income)	0.86***
BB4 (Can reach global market with organic products)	0.88
BB5 (Organic farming provides healthy food for the family)	0.94
BB6 (Organic farming improves soil fertility)	0.69***
BB7 (Organic farming protects the environment)	0.79***
BB8 (Organic farming provides healthier food)	0.89***
Favourable Attitude Towards Fully Organic Farming (AS)	
AS1 (Fully organic farming is a favourable idea)	0.80***
AS2 (Fully organic farming is possible)	0.79***
AS3 (Fully organic farming is more profitable)	0.79***
Subjective Norms Towards Organic Farming (SN)	
SN1 (Encouragement of the family for organic farming)	0.85***
SN2 (Motivation given by fellow farmers for organic farming)	0.80***
SN3 (Government's support for organic farming)	0.91***
SN4 (Motivation to organic farming by the farm advisors)	0.79
Perceived Behavioural Control (PBC)	
PBC1 (Technical ability for organic farming exists)	0.92
PBC2 (Mental capability/confidence towards organic farming)	0.78***
PBC3 (Ability to meet organic farming regulations)	0.79***
PBC4 (Affordability of the costs for converting to organic farming)	0.89***
PBC5 (Affordability of number of workers for organic farming)	0.89
Adaptability to Fully Organic Vegetable Farming (AOV)	
AOV1 (Willingness to adapt fully organic farming)	0.83***
AOV2 (Ability to take risk to move fully organic farming)	0.72***

*Levels of statistical significance, ***p <0.001.*

inspection for organic farming, the reduction of chemical output into the environment through organic farming, the perceived health benefits of organic products, and the challenge of finding wholesale buyers who are willing to pay higher prices for organic products. The findings suggest that general attitudes towards organic farming significantly and negatively contribute to adaptability for organic vegetable farming, with a standardized regression weight (SRW) of -0.352 at p <0.001 probability, thus supporting hypothesis 1 (H1).

The factor of behavioural beliefs was assessed through eight indicators, including the belief that producing organic vegetables will result in cost savings (primarily in fertilizer and pesticide expenses), the expectation of receiving higher prices for organic produce, the anticipation of increased farm income from organic vegetable production, the belief in gaining access to global markets by producing organic vegetables, the perception that organic vegetable farming provides healthy food for the family, the belief that organic vegetable production improves soil fertility, the belief that organic vegetable farming contributes to environmental protection, and the belief that organic vegetable farming ensures the provision of healthy food for the family. The factor of behavioural beliefs was identified as another significant factor that negatively influences adaptability to organic vegetable farming with the standardized regression weight (SRW) of -0.235 at p <0.001 probability, thus supporting hypothesis 2 (H2).

There were three indicators under the factor of favourable attitude towards fully organic vegetable farming: the belief that producing organic vegetables on one's farm within the next five years would be a favourable idea, the belief that such production would be possible within five years' time, and the belief that organic vegetable farming would be more profitable within the next five years than conventional farming. Analysis shows that attitudes towards fully organic vegetable farming factor significantly and negatively influence adaptability to fully organic vegetable farming, with a standardized regression weight (SRW) of -0.412 at p <0.001 probability, thus supporting hypothesis 3 (H3).

The factor of subjective norms was assessed through four key indicators,

including the encouragement of family members for organic farming, motivation given by fellow farmers, governmental support programs to motivate organic farming, and motivation given by farm advisors through guidance. Analysis shows that the factor of subjective norms significantly and negatively influences the adaptability to fully organic vegetable farming at a standardized regression weight (SRW) of -0.138 at p <0.001 probability, thus supporting hypothesis 4 (H4). These results emphasize the crucial role of subjective norms in shaping the intention to adapt organic vegetable farming among farmers.

Perceived behavioural control was assessed using five indicators, including the belief of having the technical ability to produce organic vegetables on one's farm within the next five years, the mental capability and confidence in managing organic farming in the farm within the next five years, the belief in meeting the regulations of organic farming on the farm within the next five years, the confidence in affording the costs of converting to organic farming on the farm within the next five years, and the belief in the affordability of the required number of workers for organic farming.

Perceived behavioural control exhibits a significant and negative impact on adaptability to organic vegetable farming at a standardized regression weight (SRW) of -0.468 and at p <0.001 probability aligning with hypothesis five (H5). Additionally, overall, these findings shed light on the multifaceted factors influencing farmers' decisions to adapt fully organic vegetable farming in their farms within the next five years. According to the standardized regression weights analysis, researchers can argue that though farmers have positive opinions towards organic vegetable farming, they do not have the willingness to adapt to fully organic vegetable farming on their farms in this population.

Figure 2 illustrates the structural relationships (path diagram) among farmers' perceptions of selected factors and their adaptability to fully organic vegetable farming in the study population. Further the path diagram elaborates the relationships between observed variables (indicators) and the defined factors (latent variables) of the research.

Table 6. Standardized regression weights.

Hypothesized Relationship	Estimates
H1: Adaptability to fully organic vegetable farming← General Attitudes	-0.352***
H2: Adaptability to fully organic vegetable farming ← Behavioural Beliefs	-0.235***
H3: Adaptability to fully organic vegetable farming ← Favourable Attitude Statements	-0.412***
H4: Adaptability to fully organic vegetable farming← Subjective Norms	-0.138***
H5: Adaptability to fully organic vegetable farming ← Perceived Behavioural Control	-0.468***

*** *Significant at p <0.001.*

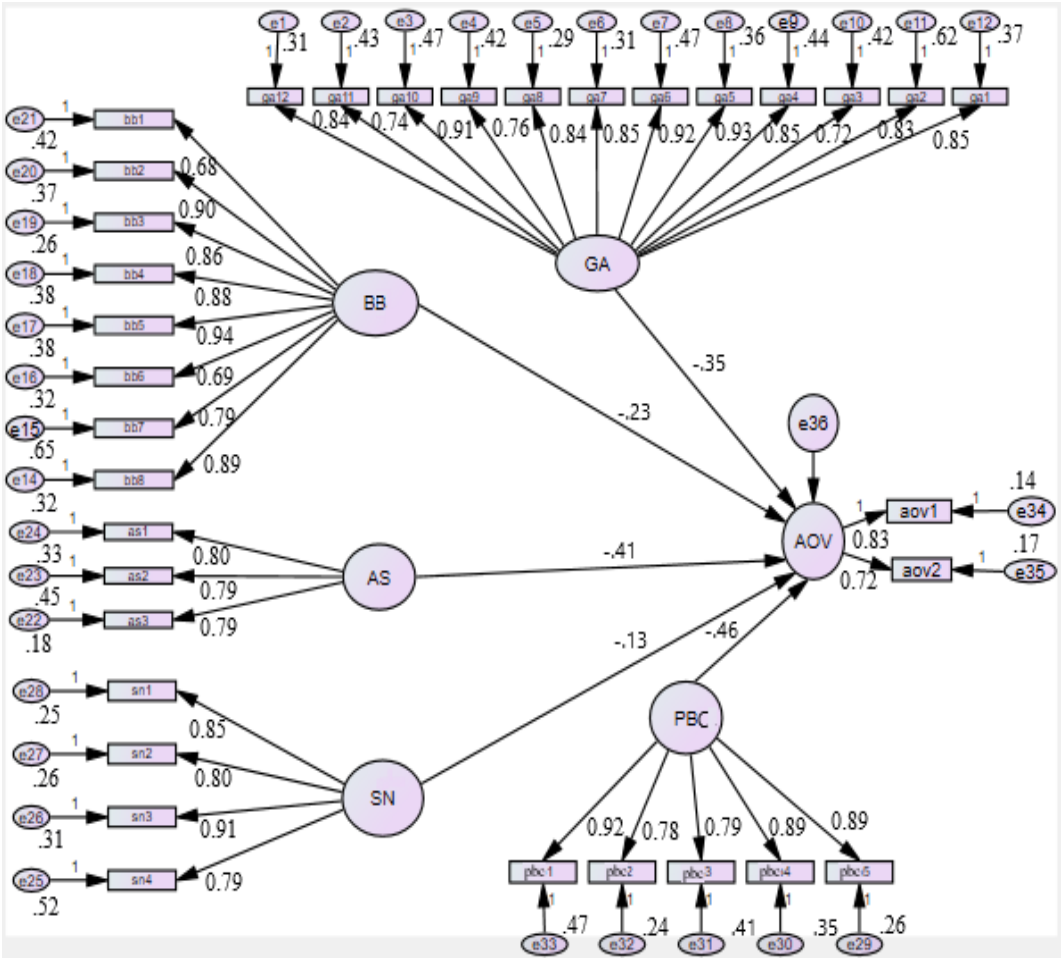

Figure 2. Structural relationships between selected variables.

CONCLUSIONS

In conclusion, farmers' adaptation to fully organic vegetable farming is significantly and negatively influenced by general attitudes towards organic farming, behavioural beliefs, favourable attitudes towards fully organic farming, subjective norms, and perceived behavioural control among farmers in this population. Confirmatory factor analysis indicates that farmers hold positive beliefs regarding the merits of organic farming across the identified factors, namely general attitudes, behavioural beliefs, favourable attitudes towards fully organic farming, subjective norms, and perceived behavioural control. Based on this, researchers can argue that although farmers maintain positive beliefs towards organic vegetable farming, they lack the willingness to fully adapt to organic vegetable farming on their farms in this population.

There are various factors that influence the adaptability of fully organic farming; thus, it requires careful consideration based on these selected factors and indicators. Among them, developing local market support for organic products, providing organic fertilizer and organic chemicals at affordable prices and making them available, and implementing government support programs are vital to converting farmers to fully organic vegetable farming in this population. Governmental support, through subsidies and guidelines, is crucial for overcoming economic barriers faced by farmers.

Further, creating awareness about the harmful effects of chemical inputs on human and animal health is crucial for promoting a shift towards organic practices. Recognizing the labour-intensive nature of organic farming and addressing challenges like organic certification-related issues is essential. Overcoming the challenge of finding business buyers willing to pay higher prices is crucial for sustaining organic farming. Without adequate support by the government and advisory services embracing fully organic farming may remain elusive.

Considering farmers' risk aversion, a phased implementation of organic agriculture may enhance overall performance. Addressing these issues identified in this study can create a more conducive environment for the

widespread adaptation of organic farming in the future.

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