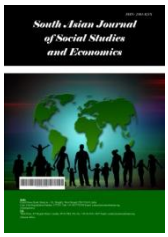

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Determinants of Market Channel Choices by Vegetable Farmers in Sri Lanka

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Purpose: The traditional vegetable supply chain in Sri Lanka is that the majority of farmers are small-scale farmers who have not had the ability or capacity to meet the final customer directly. As a result, more than 90% of the supply and distribution of vegetables is managed by a limited number of private intermediaries. It causes to distribute low profitability for producers and higher prices for consumers. The main aim of the study is to investigate factors that concurrently underpin Sri Lankan vegetable farmers' decision-making and influence their market channel choice.
Methods: Drawing on the prior studies socio-economic, institutional, and marketing factors were selected. The primary data was collected from 150 vegetable farmers in Central province through a structured questionnaire. The cross-tabulation and ordinal regression analysis were utilized to identify the significant factors.
Findings: The cross-tabulation analysis results indicated that there are significant differences in the farmers' market channel choices in relation to various socio-economic, institutional, and marketing factors. The ordinal regression analysis revealed that socio-economic factors like age, gender, education level, number of family members; institutional factors such as distance to the nearest marketplace, access to market information, farm size; and marketing factors like price offer, network build significantly affect the market channel choices of the farmers.
Implications: This study is useful to identify relationships between these variables and marketing channel choices can be further researched and these relationships can be utilized to enhance the knowledge and practices of farmers about selecting effective market channels.

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Originality: The study makes a unique and substantive contribution to the knowledge of vegetable farmers' decision-making about market channel choice in Sri Lanka and theoretically contributes to the role of socio-economic, institutional, and marketing aspects in predicting potential market choices.

Keywords: Farmers; socio-economic; institutional; marketing; market channel; ordinal regression analysis.

1. INTRODUCTION

Markets are where, as producers, smallholders buy their farming inputs and sell their products; they are where, as consumers, smallholders use income from the sale of crops or their non-agricultural activities to purchase food and other consumer goods. Empowering the farmers through commercial opportunities requires an understanding of the drivers of farmers' market channel choices, the available marketing options, the characteristics of each channel, and the tradeoffs inherent in the selection of a marketing strategy [1,2]. Markets are considered as the vital within the subsistence strategy of rural households [3]; thus, market channel choices of farmers have been studied based on the specific agricultural product, such as paddy, crop, or livestock. In this vein, the market channel preferred by a particular group of farmers may differ based on agriculture product type, while the determinant factors for channel choice may also be different.

The word vegetable applies to an edible part of a plant that can be eaten raw or cooked. Eating vegetables, which are the key sources of nutrients such as vitamins A and C, potassium, folic acid, and dietary fiber, is beneficial to one's health. Weather conditions, such as temperature and light intensity, have a direct effect on the nutritional quality of vegetables [4], (Mukiama et al., 2021). World vegetable production growth has been continuously increasing during the last three decades (1990 – 2019). Global vegetable production stood at 304 million tons in 2019, jumping by 3.2% against the previous year. The total output volume increased at an average annual rate of +2.8% over the period from 2004 to 2019; the trend pattern remained consistent, with somewhat noticeable fluctuations throughout the analyzed period. The increase in cultivation areas and change in consumer preferences towards more healthy and convenience food consumption and the rising incomes are the main reasons for this rise in vegetable production.

Sri Lanka is a perfect place to grow vegetables because of its natural and manmade facilities, the option for agriculture and the agro-based industry is like naturally rich soil and zone, as well as well distributed precipitation patterns and robust irrigation. Vegetables grown in Sri Lanka are usually divided into two categories that endorse agro-ecological adaptability, such as up-country and low-country forms, covering two monsoons periods (Yala season and Maha season). It produces more than 800,000 metric tons of fruits and vegetables annually and both fresh and processed exports [5]. While more than 80 vegetable varieties are available, grown in Sri Lanka, the upcountry is given greater importance carrots, beans, cabbage, beetroot, leeks, and other vegetables. Low-country vegetables are categorized as cucumber, brinjal, chili, a gourd of the snake, and bitter gourd [6]. For the agricultural sector, it is extremely important to Sri Lanka's economy, as it makes a substantial contribution to increased national income and thus income per capita, generate new prospects for jobs, and improve the health of people through the adequate supply of nutrients [7]. The socio-economic environment of the agricultural industry in Sri Lanka plays a vital role. The share of agriculture in Sri Lanka's GDP in 2019 is around 7% and vegetables contribute to the national GDP sub-sector. The rapid population growth, the increase in per capita income and the expansion of exports and tourism industries in the country enforce to expand vegetable production several times. With moderate climatic conditions, the availability in most parts of the country of labor with generations of agricultural experience, fertile soil, and free groundwater with a reasonably dispersed river network and an irrigation system facilitates the expansion of vegetable production in the country.

Although Sri Lanka covers a larger range of vegetable crops to be grown in various parts of the country during the year, vegetable farmers do not receive sufficient profit from their production, in return experiencing poor living standards. Besides, consumers are also struggling to get fresh-quality vegetables at a reasonable price. As shown in SAARC Report (2017), only about 112 grams per day is the per capita consumption

of vegetables, which is far from being the case (200 g/day) below the recommended dietary requirement. This is happening because more than 90 percent of the vegetable distribution is managed by a limited number of private intermediaries (collectors, contract manufacturers, wholesalers, commission, Traders, brokers, and transporters). As such, intermediates increase the complexity of the distribution system, in return low profitability for producers and higher prices for consumers with high wastages [7]. Subsequently, the majority of vegetable farmers are small-scale rural producers and they do not have the ability or capacity to meet the final customer directly, specifically in urban areas. The primary objective of every market channel is to fulfill the requirements of the manufacturer and customer. Since vegetables are highly perishable products, they need special and efficient market channels. Therefore, choosing an effective market channel is essential to receive reasonable prices to farmers as well as meet consumers' vegetable requirements and nutrition standards at a fair cost. Modern consumers are more interested in buying vegetables directly from farmers or at least are aware of the origin of their vegetables because they are concerned about freshness, quality, health, and nutritional values. Furthermore, direct marketing is not economically beneficial to small-scale growers. Literature highlighted that farmer's age, farming experience, distance from the area of production to the market, membership in the farmer association, extension touch, education level, producer bargaining power, additional post-harvest value, ownership of livestock, access to credit, family size and so on are critical determinants of the choice of market channel of farmers [8,9,10]. On these notes, the present study intends to identify factors that affect the choice of market channels for vegetable farmers in Sri Lanka. Understanding the determinants of farmers' decision-making associated with market channels choices is of particular interest to multiple stakeholders in the vegetable value chain. This study aims to examine how socio-economic, institutional, and marketing factors concurrently underpin Sri Lankan vegetable farmers' decision-making and influence their market channel choice.

1.1 Determinants of Market Channels Choices

Marketing channel choice is often considered one of the most complex and challenging decisions facing smallholder farmers [11]. Xaba & Masuku [10] opined that direct market channels are the most appropriate for vegetables since vegetables are highly perishable products. However, the development of transportation, storage facilities, and so on demonstrates that this presumption of the need for a direct market channel for vegetables is no longer valid. In Sri Lanka, rural markets/fairs ('Pola') are a good example of marketplaces where farmers and customers meet directly. But with the development of transportation farmers got the chance to sell their products to markets outside their territory and thereon the wholesale markets and other marketing channels emerged for vegetables in Sri Lanka. The market channel can be defined as a set of interdependent organizations involved in the process of making a product or service available for consumption or use [12]. Accordingly, all the alternative methodologies that farmers can use to deliver their crop to the intended consumers can be identified as the marketing channels available to these vegetable farmers. Typically, there are three most common marketing destinations for the produce of smallholder farmers, namely fresh produce markets, informal markets, and supermarket chains [13]. Following that dedicated economic centers, supermarkets, wholesale markets, retail markets, roadside selling, and online selling can be identified as the market channels available for vegetable farmers in Sri Lanka (Gunerathna & Bandara, 2020; Nuskiya, 2019). The prior studies have identified different factors that influence the decision of the market channel choices of the farmers. The wide variety of factors identified by these scholars as to have an impact on the marketing channel choices can be broadly classified into three categories as socio-economic factors, institutional factors, and marketing factors.

Accordingly, socio-economic factors like age, gender, marital status, number of family members, education level, and so on have been revealed as significant determinants of market channel choices of the farmers. On this note, Tura and Hamo [9] and Xaba and Masuku [10] indicated that when a farmer grows older the network a farmer has would become large and this would help the farmer to access more and more new marketplaces which are profitable and convenient. Further they revealed that many of the old farmers rely on the traditional marketplaces (like retail selling, wholesale markets, etc.) rather than the new and emerging marketplaces like supermarkets and online

selling. In contrast, Kyomugisha et al. [14] insisted that younger farmers proved enthusiastic and eager to seek market opportunities, whereby younger farmers with effective coordination and risk-taking ability seek urban markets far away from their rural farm locations. The education level also is a factor that affects the marketing channels of the farmers. Taye, et al. (2018); Siddique [15]; Emana, et al., [16] opined that farmers who had a formal education to a great extent compared to the other farmers were noticed using more novel modes of vegetable selling like online selling as they believe online modes are less costly and can charge a price premium in such marketplaces. Moreover, the education level allows the farmers to evaluate the different marketing channels available for them and to choose the most profitable marketplace by taking into consideration all the factors. Siddique [15] further argued that the more educated farmers would tend to go for novel marketing channels like opening an e-commerce website or selling their products through social media etc. Interestedly, Tura and Hamo [9] claimed that the same expertise about the return can be developed with experience in the farming industry as no extensive calculations, analysis, and research is required to make these decisions. Further, Tura and Hamo [9] further found that gender affects the market channel choice of the farmers. Accordingly, the female farmers would tend to choose a marketplace by considering the amount of harvest and the distance to the marketplace. So, the female farmers would choose the nearest marketplace while male farmers would give less priority to the distance when choosing their marketplace. Finally, a number of family members could also affect the selection of different market channels. A family with a large number of members would enable the farmer to sell his/her harvest to different marketplaces at once and even to markets far away from the farm. Therefore, the market channel choices of the farmers with a high number of family members would be dispersed among all the available market channels. Considering the arguments in prior studies, the present study aims to investigate the several socio-economic factors, namely farmer's age, gender, education level, experience in farming, number of family members and ownership of a mobile phone, influence over the market channel choice of the vegetable farmers in Sri Lanka.

The institutional factors like farmland ownership; quantity of harvest produced, access to information and credit facilities, and size of the farm have been identified as determinants of market channel choices of farmers [5,10,15], (Taye, et al., 2018). All the parties involved in the agriculture supply chain is required to know all information related to the market and need to have a method of getting information easily. Therefore, access to market information through economic centers, wholesale market, retail market, government, farmers' association, and from neighboring farmers is important because the profitability of the vegetable market depends on the choice of proper market channel. The farm size and the quantity of vegetables produced affect the channel that the farmer uses [16]. Not all the marketing channels are appropriate for all the quantities of harvest. Some channels like retail selling, roadside selling cannot be used alone if the farmer is producing a large quantity of vegetables. So willingly or unwillingly in such instances, the farmer would have to go for some marketplaces which he/she can sell a large quantity like wholesale markets. Taye, et al. (2018) opined that the farmers who have a vehicle of their own tend to sell their harvest to the most profitable marketplace. They do not have issues transporting the harvest so they can transport their crop even to a longer distance if such marketplaces yield them better returns. Moreover, farmers who take credit facilities from the government tend to sell their products mostly to the dedicated economic centers as in most of the instances these loan and credit schemes require the farmers to sell their harvest to markets like dedicated economic centers as a qualifying factor to apply for such credit/loan facilities. As Nuskiya [5] emphasized, the farmers who are members of farmers' associations are motivated to sell their products mostly to the traditional marketplaces. Acknowledging the prior study's findings, the study selected production quantity, own a transport facility, access to market information, access to credit, membership in a farmers' organization, engagement in non-farming activities, and farm size as the institutional factors that could be influenced to select the market channel of the vegetable farmers in Sri Lanka.

When it comes to marketing factors, Emana, et al. [16]; Xaba & Masuku [10]; Siddique [15] Thamthanakoon [17], and Thamthanakoon et al. [18] commonly indicated that the distance to the nearest marketplace is one of the most important factors affect the farmers choice of market channel. Here, Thamthanakoon [17] and

Thamthanakoon et al. [18] argued that most of the farmers in the less-developing countries would tend to choose the closest marketplace as their primary market channel choice due to the costs associated with transportation. Further, he argued that the middlemen would try to keep a higher margin on the crop of the farmers by purchasing the crop at a very low price. This would force the farmers to choose the nearest marketplace as their primary (and the only, in most cases) marketplace sometimes even at lower prices they get at the nearest marketplace. As opined by Emana, et al. [16], the farmers who do value addition to their crop sometimes will not be able to sell their harvest at certain marketplaces. For example, value-added products may have less demand in retail markets and wholesale markets but would have a good demand in online marketplaces and supermarkets as they are designed to sell similar value-added products. Therefore, the farmer's value to the harvest would affect their marketing channel choice. In addition, Siddique [15] opined that farmers prefer to sell their products to the market where customers' bargaining power is low. So, farmers offer fair prices to the products due to less competition in the market. Looking at the marketing factors, the study selec post-harvesting value addition, distance to the nearest market, network building, and price offer as influencing factors when selecting the market channel of the vegetable farmers in Sri Lanka.

2. METHODS

The study intends to identify the factors which affect the farmers' choice of their market channels and here the study selected different factors under the broad categories of socio-economic, institutional, and marketing factors based on the prior studies. Hence, the positivistic research approach is employed with quantitative research methods. The target population of the study consisted of commercially cultivated farmers in Central province, Sri Lanka. The reason behind the selection of Central province farmers was that the province covers the districts (Nuwara Eliya, Kandy, Badulla, and Matale) which account for 70.3 percent of the Maha season's vegetable production and 74.1 percent of upland vegetable production in the Yala season [19]. This province is identified as a wet zone region with an average annual rainfall of more than 2,500 mm without a distinct dry season. The climate is suitable for the production of vegetables for the entire year and large quantities of vegetables, therefore, are grown on intensive and industrial scales. As per the records of the Department of Census and Statistics [20], there were around 300,000 farmers in the Central province representing Kandy, Matale, Badulla, and Nuwara Eliya districts. However, a database including farmers' details was not properly established. Therefore, the study had to use a non-probability convenience sampling technique to select the respondents. Since the farmers in Central Province were spread in a large geographical area, the study selected two Gramaniladari divisions of each district in the province to get wide representatives to the study. Accordingly, 270 farmers were selected as the sample of the study. The study used primary data collected from the selected sample to achieve the desired objective. A structured questionnaire was developed, including demographic details of the farmers and 19 measurement items represented the selected socio-economic, institutional, and marketing factors. Table 1 shows the operationalization of the selected factors in the study.

Table 1. Operationalization

Factors	Dimensions	Code	Measurement Scale	Measurements
Socio-economic factors	Age	AGE	Ordinal	Below 25 years 25 – 45 years 45 – 65 years Above 65 years
	Gender	GE	Nominal	Male Female
	Education level	EDU	Ordinal	No formal education Primary education Secondary education Tertiary education
	Number of family	No FM	Ordinal	Less than 4

Factors	Dimensions	Code	Measurement Scale	Measurements
	members			4 to 10 Above 10
	Farming experience	FE	Ordinal	Below 5 years 5 – 15 years 15 – 25 years Above 25 years
	Mobile phone ownership	MPO	Nominal	Yes No
Institutional factors	Access to market information	ATMI	Nominal	Dedicated economic center Wholesale market Retail market Marketplace owner Neighboring farmers Government Farmers association Other
	Access to credit	ATC	Nominal	Credit taken from government bank Credit taken from Farmers association Credit taken from private sectors/NGO Credit taken from Individual lender Others Not access to the credit
	Quantity of vegetables produced per season	QOVP	Ordinal	Under 100kg 100kg – 500kg 500kg – 1000kg Over 1000kg
	Membership in a farmers' organization	MIFO	Nominal	Yes No
	Farm size	FS	Ordinal	Below 1 acre 1 acre – 2 acres 2 acres – 5 acres Above 5 acres
	Non-farming activities	NFA	Nominal	Yes No
	Ownership of transport vehicles	OTA	Nominal	Yes No
Marketing factors	Price offer	PO	Nominal	Decide based on the market price Offered by buyer Calculate Based on cost
	Post harvesting value addition	PHVA	Nominal	Add value addition to the vegetables Not add value sell as raw material
	Distance to the nearest market	DTNM	Ordinal	Less than 10km 10km – 20km 20km – 50km More than 50km
	Network build	NB	Nominal	Participate farm association Contact with agriculture officers in the area

Factors	Dimensions	Code	Measurement Scale	Measurements
Market Channel Choices			Nominal	Negotiate with other farmers Dedicated economic center Supermarket Wholesale market Retail market Roadside Online

Using the collected data from the questionnaire, a descriptive analysis was carried out initially to identify the nature and characteristics of the sample. A crosstab analysis was carried out to identify the differences in the market channel choices of the farmers about the different marketing, demographic, and institutional factors. The study used ordinary and nominal scale type measurements and dependent variables were measured using nominal scale measurement. Therefore, an ordinal regression analysis was employed to identify the significant factors that affect the market channel choices of the selected farmers in the study.

3 RESULTS

The survey was conducted with 270 farmers and 150 completed responses were received, indicating 55% of the response rate. The characteristics of the responders are described in terms of gender, age, farming experience education level, and market channel choices. Table 2 illustrates the demographic characteristics of the respondents, demonstrating that respondents were capable to fulfill the desired objective of the study.

A crosstab analysis was carried out to identify the differences in the market channel choices of the farmers about the marketing, socio-economic, and institutional factors. The results of the crosstab analysis are shown in Table 3.

As shown in Table 3, all the respondents below age 25 have chosen online market channels to sell their products to customers. This may be because the younger generation is more attached to the online sorts of things rather than traditional modes. And more than half of the respondents in the age of 25-35 are using roadside selling as their channel of distribution. Only 12.9% of respondents of this age group were using online and supermarket channels. And when it comes to the age group 35-45, nearly half of the respondents (49.2%) use wholesale markets as the market channel. And the farmers of this age group also use supermarkets and retail markets to sell their products. Dedicated economic centers (37.5%) are the most popular and wholesale markets (28.1%) are the second most popular mode of the market channel among the farmers of age 45-55. The farmers above 55 years use either supermarkets or retail markets to sell their products while a majority of farmers (85.7%) rely on supermarkets. Female farmers use only wholesale (64.0%) and retail (36.0%) markets to sell their products while male farmers are distributed among all the six different marketing channels available. From them, 28.8% use supermarkets, and 19.2% use wholesale markets. When it comes to the group of respondents who have never obtained a formal education, 66.7% of such farmers sell their products through dedicated economic centers, while 22.2% and 11.1% sell their products through supermarkets and retail markets, respectively. The farmers who have received education up to the primary level are more oriented towards supermarket selling (43.1%) while majorities (67.9%) of the farmers who have learned up to the secondary level prefer to use wholesale markets. And the majority of the farmers (35.7%) who have tertiary education either use roadside marketing or online platforms to sell their products.

When the number of family members increases, the farmers tend to change their marketing channel from supermarkets to wholesale markets and then to retail markets gradually. Farmers with family members 4-10 use all the six marketing channels while wholesale markets are the most popular among them. The farmers with the least experience (less than five years of farming) use online platforms to sell their products and almost half of the farmers with 5-15 years of farming experience use supermarkets to sell their products while 61.5% of the farmers with 15-25 years of experience use wholesale markets. The most experienced category of farmers with more than 25 years of experience, equally prefers supermarkets and

retail markets (38.5% each) whilst the rest use dedicated economic centers. The majority of the farmers who have a marketplace within the distance of 10Km tend to use retail and wholesale markets equally.

Table 2. Demographic Characteristics

Characteristic	Frequency
Gender:	
Male	125
Female	25
Age:	
Below 25 years	10
25 – 45 years	31
45 – 65 years	63
Above 65 years	32
Farming experience:	
Below 5 years	09
5 – 15 years	24
15 – 25 years	65
Above 25 years	52
Education level:	
No formal education	18
Primary education	65
Secondary education	53
Tertiary education	14
Market Channel Choices:	
Dedicated economic center	18
Supermarket	36
Wholesale market	40
Retail market	25
Roadside	17
Online	14

Table 3. Crosstab Analysis

Factors		Dedicated Economic Center	Super market	Wholesale market	Retail market	Roadside	Online
Age	under 25	0	0	0	0	0	10
	25 - 35	6	4	0	0	17	4
	35 - 45	0	16	31	16	0	0
	45 - 55	12	4	9	7	0	0
	Over 55	0	12	0	2	0	0
Gender	Male	18	36	24	16	17	14
	Female	0	0	16	9	0	0
Education level	no formal education	12	4	0	2	0	0
	primary	0	28	2	19	12	4
	secondary	6	4	36	2	0	5
	tertiary	0	0	2	2	5	5
No. of family members	Under 4	6	13	5	0	0	7
	4-10	4	3	21	2	17	7
	Over 10	8	20	14	23	0	0
Farming experience	Under 5	0	0	0	0	0	9
	5 -15	2	12	0	0	5	5
	15-25	4	4	40	5	12	0
	Over 25	12	20	0	20	0	0

Factors		Dedicated Economic Center	Super market	Wholesale market	Retail market	Roadside	Online
Distance to the nearest market	Under 10km	2	0	7	7	0	0
	10km-20km	12	16	7	4	12	4
	20km-50km	4	8	11	7	5	10
	Over 50km	0	12	15	7	0	0
Access to market information	Dedicated economic center	4	8	0	0	0	0
	Wholesale market	10	8	15	4	7	0
	Retail market	0	16	2	0	0	4
	Market place owner	0	0	9	5	0	0
	Neighboring farmer	0	4	0	0	10	5
	Government	4	0	9	12	0	0
	Farmers association	0	0	5	4	0	5
Access to the credit	From government bank	2	20	0	0	0	5
	From farmers association	0	4	9	5	12	0
	From private sector/ NGO	12	4	7	7	0	9
	Individual lender	4	8	15	6	0	0
	Other	0	0	9	7	5	0
Quantity of vegetable production	Under 100kg	8	4	0	5	7	0
	100kg-500kg	0	16	17	7	0	5
	500kg-1000kg	0	12	9	6	5	0
	Over 1000kg	10	4	14	7	5	9
Membership in farmers organization	Yes	8	16	12	6	17	5
	No	10	20	28	19	0	9
Post harvesting value addition	Add value addition to the vegetables	0	12	9	7	0	5
	Not add value sell as raw material	18	24	31	18	17	9
Farm size	Under 1 acre	0	12	7	0	12	4
	1 acre-2 acre	4	8	9	11	0	0
	2 acres-5 acres	14	8	17	9	0	10
	Over 5 Acres	0	8	7	5	5	0
Mobile phone ownership	Yes	10	20	38	15	0	14
	No	8	16	2	10	17	0
Off-non farming activities	Yes	4	20	23	4	10	9
	No	14	16	17	21	7	5

Factors		Dedicated Economic Center	Super market	Wholesale market	Retail market	Roadside	Online
Ownership of transport asset	Yes	2	12	24	16	7	4
	No	16	24	16	9	10	10
Price offer	Decide based on the market price	4	8	16	7	7	0
	Offered by Buyer	2	12	5	9	5	14
	Calculate Based on cost	12	16	19	9	5	0
Network building	Participate farm association	4	0	14	0	5	0
	Contact with agriculture officers in the area	0	24	17	9	5	14
	Negotiate with other farmers	14	12	9	16	7	0

Table 4. Test of Parallel Lines

Test of Parallel Lines				
Model	**-2 Log-Likelihood**	**Chi-Square**	**df**	**Sig.**
Null Hypothesis	339.382			
General	336.915	2.767	68	1.000
The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.				
a. Link function: Logit.				

While the farmers who live within a radius of 10Km – 50Km use all the six different marketing channels available for them. The farmers who have the nearest marketplace away from 50Km use only supermarkets, wholesale, and retail markets while the majority (44.1%) sells their products at wholesale markets. The farmers who have access to the market information from economic centers and retail markets tend to sell their products to supermarkets while the farmers who access market information from wholesale markets, marketplace owners, and farmers associations, sell their products to wholesale markets. The majority of the farmers who have access information from the government tend to rely on retail markets to sell their products. Finally, the majority of the farmer's access to credit facilities from the government sell their products to supermarkets while the majority of the farmers get access to credit from farmers' association and the private sector tend to sell their products in roadside and to economic centers respectively. Other farmers who access credit from individual lenders and other sources mostly use the wholesale markets.

The quantity of vegetables produced by a farmer also affects their marketing channel choices. The majority of the farmers who produce less than 100Kg have selected an economic center to sell their products while the farmers which produce 100Kg – 1,000Kg mostly use supermarkets to sell their products. Due to the large quantity produced, the farmers who produce above 1,000Kg are distributed among the six different marketing channels. Most of the farmers with a farm size of less than 1-acre use either roadside or supermarkets to sell their products while the farmers with a farm of size 1-2 acre use retail markets. The majority of the farmers who's farm is between 2-5 acres use wholesale markets and the farmers having a farm above 5 acres farm use supermarkets to sell their products. And the majority of the farmers who are members of the

farmers' association sell their product to the wholesale market while the majority of the farmers who have links with the agricultural officers of the area sell their products to the supermarkets. Irrespective of the facts, whether the farmer is a member of a farmers' association or not, whether the farmer has a mobile or not, whether the farmer does any value addition to the harvest or not, whether the farmer owns a transport vehicle or not and the pricing decisions farmers are dispersed among all the six different marketing channels available.

3.1 Ordinal Regression Analysis

The results of crosstab analysis indicated that there were differences in the market channel choices of farmers based on different socio-economic, marketing, and institutional characteristics. Hence, it is required to identify the factors which affect significantly to select of the market channels of the farmers in the study. The ordinal regression analysis was carried out to achieve that purpose.

Unlike a multinominal regression model, the ordinal regression generates only one regression model for all thresholds and so the ordinal regression model assumes that the slope coefficients of the model at every threshold is equal (constant). To test this assumption, the test of parallel lines could be used. The parallel lines test (Table 4) indicates that determining a single regression model across all the thresholds is not appropriate and a less restrictive model (i.e., a multinominal regression) needs to be developed. But the results of the test of parallel lines indicate that the null hypothesis (H_0 – *The slope coefficients are the same across the thresholds)* cannot be rejected and so, the assumption of proportional odds is held. Hence one regression model can be used across the thresholds.

The results of the model summary in the ordinal regression model were given in Table 5. The result of the model fitting information suggests that the regression model statistically improves the prediction ability over the baseline model. And this improvement is statistically significant at a significance level of 1% concluding that the overall regression model is statistically significant. Further, the goodness of fit test results; the Pearson and Deviance test results are given in Table 5. These tests are additional tests of model significance and tests whether the observed data is consistent with the model or not. The null hypothesis: the fit is good is tested and the results indicate that the regression model does not fit very well since both the Pearson and Deviance tests reject the null hypothesis at a significance level of 5%.

The Cox and Snell, Nagelkerke, and McFadden pseudo-R squares can be used to evaluate the overall explanatory power of an ordinal regression model. These pseudo-R square values of the regression model are given in Table 5. Accordingly, the regression model has an explanatory power of 71.8% with a minimum of 34.6%. This implies that the model can explain around 72% of the variance of the farmers' choice of market channel.

Table 5. Model Summary

Model Fitting Information				
Model	**-2 Log-Likelihood**	**Chi-Square**	**df**	**Sig.**
Intercept Only	514.847			
Final	336.915	177.932	17	.000
Link function: Logit.				
Goodness-of-Fit				
	Chi-Square	**df**	**Sig.**	
Pearson	9424.908	143	.000	
Deviance	336.915	143	.000	
Link function: Logit.				
Pseudo R-Square				
Cox and Snell		.695		
Nagelkerke		.718		
McFadden		.346		
Link function: Logit.				

Table 6. Parameter Estimates

Factors	Estimate	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
AGE	.457	.431	.289	-.388	1.302
GEN	-3.711	.826	.000*	-5.330	-2.092
EDU	2.037	.436	.000*	1.182	2.892
No FM	.124	.349	.722	-.560	.808
FE	-1.509	.424	.000*	-2.340	-.677
MPO	1.780	.519	.001*	.763	2.798
ATMI	1.671	.261	.000*	1.160	2.183
ATC	.274	.267	.304	-.249	.797
QOVP	-.285	.329	.386	-.930	.359
MIFO	-.035	.593	.953	-1.198	1.128
FS	-1.275	.272	.000*	-1.807	-.743
OTA	-1.242	.720	.084	-2.653	.169
NFA	-1.033	.501	.039*	-2.016	-.051
PO	-1.875	.389	.000*	-2.638	-1.113
PHVA	5.623	.991	.000*	3.681	7.566
DTNM	1.572	.422	.000*	.745	2.399
NB	2.183	.518	.000*	1.166	3.199

Link function: Logit.

Moreover, the parameter estimation of the ordinal regression analysis was illustrated in Table 6.

As shown in Table 6, the estimates of each independent variable indicate the change of the log odds ratio of a farmer selecting another market channel in response to one unit change in the respective independent variable. And the significant values of these independent variables indicate whether these variables are statistically significant within the regression model given that the other predictors are also in the regression model. In other words, the significant value tests whether the coefficient of the variable is different from zero or not. The regression results suggest that the socio-economic factors such as gender, education level, years of farming experience, and ownership of a mobile phone were statistically significant factors towards the farmers' market channel choices. When it comes to institutional factors, access to market information, farm size, and engagement with non-farming activities were significant predictors of the farmers' choice on the market channel. About the marketing factors, price offer, post-harvesting value addition, distance to the nearest market, and network building have a statistically significant influence on the marketing channel choices of the farmers. The factors, age, number of family members (socio-economic factors), access to credit, the quantity of production, membership of a farmers' association, and ownership of a transport vehicle (institutional factors) were found as the insignificant factors; that do not have a statistically significant influence on the marketing channel choices of the farmers.

4. DISCUSSION AND IMPLICATIONS

The main aim of the study is to investigate the choice of a market for vegetables by smallholder farmers, specifically; the study intends to identify factors that affect the choice of market channels for vegetable farmers. The ordinal regression results assert that socio-economic factors like farmer's gender, education level, years of farming experience, and mobile phone ownership are the significant determinants of the market channel choice of the farmers. These results are consistent with the findings of Tasye et al. [21] and Tura and Hamo [9]; opined that gender and the education level of farmers are significant determinants of selecting a market channel. Female farmers would tend to choose the marketplace close to the farm irrespective of the price or any other concerns as it would make the task easy and would not require much effort. Emana et al. [16] and Tura and Hamo [9] indicated that experience in farming affects the marketing channel selection decisions of farmers. The education level of the farmer would help the farmer to evaluate the different market channels available. Moreover, based on the costs, efforts, and trading volumes, the farmers would make the decision and it was revealed that farmers who have learned (comparably) well have centered on the market channels with the

least costs and highest trading volumes. In terms of farming experience, as long as the farmers engaged in farming and selling the crops they would acquire knowledge with experience which is required to choose the best market marketing channel for them [15]. In addition, Siddique [15] argued that the education level would affect the market channel choices as the more educated (comparably) farmers would search for alternative channels to sell their products rather than relying on the traditional channels. Such farmers would tend to sell their products online and some farmers were found to have even e-commerce like websites for their own.

Access to market information, farm size, and engagement with non-farming activities are identified as the significant determinants under institutional factors. Siddique [15] opined that the size of the farm would affect the channel of market choices of a farmer. When the size of the farm increases the amount of crop produces can be expected to increase and farmers would choose a marketplace that he/she can transport. In reality, a large quantity of crops could be easily sold at the closest marketplace at minimum transportation costs. The majority of the farmers in the study acquire market information from the wholesale market (Table 3). When farmers deepen with market information like price, demand, supply, weather and policy decisions, they can forecast possible market places and the profit margin of their products [5]. The results further indicated that farmers who are engaging with non-farming activities (such as construction, education) more likely to select wholesale and supermarkets to sell their products (Table 3). Due to the engagement with other career activities, those farmers would have more opportunities to access the information and form contacts, and then they would be able to expand their selling options.

Inconsistent with the findings of Emana et al. [16] and Xaba and Masuku [10], all the marketing factors; price offer, post-harvesting value addition, distance to nthe earest marketplace and the way the farmer builds up the network, was found to be the significant determinants of the market channel choices. The distance to the nearest marketplace is one of the crucial factors affecting the marketing channel choices of farmers [17,18]. The cross-tabulation results (Table 3) acknowledge this argument, highlighting that when the distance of nearest marketplace is getting wider, farmers prefer to choose a wholesale market, where middlemen would try to keep a higher margin on the crop of the farmers by purchasing the crop at a very low price. As a positive sign, the cross-tabulation results further highlighted that when the distance of the nearest marketplace is getting wider, farmers prefer to use online selling. Interestedly, cross-tabulation results revealed that farmers who make value addition to their vegetables more prefer to choose supermarket as the market channel and regression results confirmed the importance of value addition when selecting market channels. This is a novel finding and prior studies did not concern with the value addition component adequately. Most of the supermarket channels in Sri Lanka now pay stern attention to value-added products than raw products and they provide quality transportation facilities in order to protect the freshness of the vegetables. Network building was found to be a significant determinant of the marketing channel choices of the farmers in the Central Provinces. Here, farmers' associations and agricultural officers play a crucial role in developing networks among farmers and in return farmers get benefits by selecting suitable marketplaces to sell their products at reasonable prices.

The findings of the study indicate that factors like access to market information, post-harvesting value addition, and engagement with non-farming activities are exceptional significant determinants of marketing channel choice in Sri Lankan vegetable farmers. The policy makers and regulators in the area of agriculture, specifically vegetables can utilize these findings in developing strategies and policies with regard to uplifting the living standards of farmers and offering fresh-quality vegetables to consumers at reasonable prices. The way the farmers' access market information is a significant determinant of the marketing channel choice, hence the regulatory authorities can make available such information to the farmers and at easy access so the farmers can make informed decisions about their marketing channel. Similarly, post-harvesting value addition is also a significant determinant. There could be some farmers who do not have adequate knowledge or expertise to engage in some kind of post-harvesting value addition activity and due to the same fact, who do not have access to marketplaces like supermarkets and online stores. Hence these regulators can enhance the knowledge of these farmers regarding post-harvest value addition by means of training and development programs and so on. Moreover, developing network building capacity of the farmers needs to be

considered. Establishing the links with farmers' associations and other such communities, supermarket channels and other food-related industries can contribute to enhancing the knowledge of farmers on market channel choices. Specifically, these networks would encourage the farmers to engage with online selling options. The findings highlight the need for policy to address issues in socio-economic, institutional, and marketing aspects to empower farmers through the improvement of effective market selection.

5. CONCLUSION

The study makes a unique and substantive contribution to the knowledge of vegetable farmers' decision-making about market channel choice in Sri Lanka and theoretically contributes to the role of socio-economic, institutional and marketing aspects in predicting potential market choices. The study mainly intends to identify factors that affect the choice of market channels for vegetable farmers in Sri Lanka and how these factors influence to selection the market channel has not been examined. The exact relationships among these factors and marketing channel choices could be further researched, using a qualitative research approach. Further, the scope of the study is limited to the farmers in a particular province, hence the generalizability of the findings might be restricted. Thus, further study could include other provinces and could perform comparative analysis. Finally, future studies could take different market channels separately and perform in-depth analysis to identify what exact factors influence farmers to choose that market channel.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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