

# Analysis of Factors Influencing Consistency of Contracted Small Holder Vegetable Farmers to Supply National Agricultural Marketing Board in Eswatini

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Available online at: [www.isroset.org](http://www.isroset.org)

Received: 07/July/2020, Accepted: 24/July/2020, Online: 31/July/2020

**Abstract-** The National Agricultural Marketing Board (NAMBoard) in Eswatini is faced with a challenge of inconsistency supply of vegetable by its contracted smallholder farmers. The objectives of the study were; to determine the socio-economic characteristics of contracted smallholder vegetables farmers that supply to the NAMBoard; to assess the factors influencing the consistency of contracted smallholder vegetables farmers that supply NAMBoard and to determine the challenges associated with the smallholder farmer's probability of inconsistently supplying to NAMBoard. The study was conducted in the Manzini region of Eswatini, targeting smallholder farmers operating on a commercial basis and contracted to National Agricultural Marketing Board. 123 vegetable farmers were randomly sampled for the study. A Multinomial logistic regression model was used to analyze factors influencing the consistency of contracted smallholder farmers to supply vegetables to the National Agricultural Marketing Board. Socio-demographic results indicate that majority of smallholder vegetable farmers were males (66.2%) and with the average age 50 years old. The challenges associated with the probability to supply the Market inconsistently included lack of access to seed and lack access to seedlings, difficulties in accessing fertilizer, lack of produce storage, and shortage of farmland. The study recommended that policies aimed at availing resources for improved productivity of vegetables should be gender sensitive to empower women and youth with productive resources so that they can also be able to consistently supply markets; public private partnerships (PPP) from government and Non-Governmental Organizations should be formed and used as programmes offering institutional support so that smallholder farmers can consistently participate in lucrative formal markets; farmers should form partnerships or associations to be able to supply formal markets, and government should invest in improving road infrastructure particularly feeder roads that link farmers to major high ways.

**Keywords-** Smallholder vegetable farmers, Contract farming, Consistency

## I. INTRODUCTION

The agricultural sector in Eswatini is characterised by a dualistic nature consisting of modern and traditional sectors. About 80 % of the Swazi population lives on Swazi Nation Land (SNL). They derive their livelihood from subsistence agricultural production [1]. Vegetable production on SNL is practiced by subsistence farmers and less than 7 percent of all SNL are planted to rain-fed crops, with maize being the most important crop. Vegetables are among the crops that are being promoted by the Government of Eswatini through the Ministry of Agriculture for more than three decades. Eswatini has good physical environment for enabling vegetable production [2]. The climate favours the production of different types of vegetables, while soils are also generally good and water for crop production is adequate [2]. However, improvements in ensuring water distribution would improve the competitiveness of the horticulture sector. The horticulture sub-sector has been thriving for some time now, and baby vegetables can be traced back to

late 1990s. The baby vegetable industry continues to gain significant share of the export market and predicted increased demand [1].

According to Xaba and Masuku (2013), the total consumption of fresh vegetables in Eswatini is estimated around 40,000 tonnes per year and this translate into 40 kg per capita consumption per year. Individuals who have relatively higher purchasing power consume above the annual per capita of 40 kg in contrast to a poor individual living in rural areas, who consume less than the per capita vegetables [3]. According to Vilakati (2007), when choosing suitable market outlets, the following factors have to be considered; the volume of the produce you will be growing, the time you have available for marketing during the growing season, your willingness, time and ability to deal with customers directly, the perishability of your produce and finally, price levels and price stability of the market, and barriers to market entry and expansion [4]. The majority of farmers in Eswatini are smallholders, hence they are faced with high production and transaction

costs. This results in farmers not being able to sustain their livelihood [5]. According to Gebrehiwot (2017) factors such as inadequate markets, low prices, a lot of intermediaries and inadequate marketing institutions and interaction among farmers make it impossible for smallholder farmers to take part in formal markets [6].

Eswatini has a wide range of marketing systems including farmer markets, cooperative markets, contract markets and corporate markets. The interests of small-scale farmers are protected through farmer markets and cooperative markets, while the contract and corporate markets mostly cater for the commercial farms. The traditional markets found in most towns receive vegetables from local vendors who buy at the farm gate and deliver to the markets, however some traditional markets choose to buy from bigger and more trustworthy farmers in South Africa due to the unevenly distributed areas of production and the unreliable local produce supply [7].

In 2015, NAMBoard saw an exponential increase in the levels of the produce that reached the market which grew from over 4 metric tons to 130 metric tons in the year 2015 [8][9]. However, scheduled vegetable products imported into Eswatini amounted to E824 million in the year under review, showing an increase of E116 million when compared to E708 million in 2014/15. Wheat was the largest contribution with E155.6 million, followed by yellow maize E134 million, whole maize E102.6 million, and fruit and vegetables with E89.6 million. In terms of volumes of produce, 216 314 metric tons was imported into the country compared to 185 191 metric tons in 2014/15 showing an increase of 31 metric tons translating to 17% increase [9]. To close this gap NAMBoard has introduced several measures including enforcement of contract farming with local farmers.

Contract farming (CF) is not a new concept; it was used in the 19th century in Asia and Latin America. In the 20th century it spread in Europe and United States then eventually introduced in North and Sub-Saharan Africa [10]. According to Prowse (2012), it is an agreement between a producer (farmer) and the integrator (agribusiness firm) which involves the lending of seeds, fertilizer, pesticides and many other inputs with specific marketing arrangements [11]. The agreement between the two parties must specify price, quality, quantity, delivery requirements and remuneration for work done [12]. Singh (2002), identified a series of problems associated with contract vegetable production in Punjab state in India: imbalanced power between farmers and companies, violation of the terms of the agreements, social differentiation, and environmental unsustainability [13]. Nonetheless, his surveys reveal that most contract farmers have seen incomes rise and are satisfied with the contract arrangement. A number of studies have examined the proportion of contract farmers that are smallholders. Guo, et al. (2005), analysed the determinants of contract farming participation with farm-level survey data from China [14]. Similarly, a horticultural exporter in Thailand started

producing its own horticultural products on company land and later shifted to smallholder contract production [15]. Minot and Ngigi (2004), described the evolution of several contract farming schemes in Kenya, including one (Del Monte pineapple) that gave up on contract production and others than have shifted from large-scale to small-scale production [16]. In Senegal, green bean exporters switched from small-scale contract production to large-scale production [17]. These findings confirmed the comparative advantage of smallholder.

Considering that agriculture remains a major sector in most economies in sub-Saharan Africa including Eswatini, commercialization of the sector requires improving the ability of smallholder farmers to participate in markets. Markets and improved market access plays an important role in improving rural incomes of smallholder farmers [18]. Despite these factors, participation of smallholder farmers in markets in most sub-Saharan Africa countries remains low due to a range of constraints. One of the limiting constraints faced by smallholder farmers is linked to poor market access [19]. In rural areas, farmers lack sufficient means to overcome the costs of entering the market due to high transaction costs [20]. Poor infrastructure and weak institutions cause transaction costs to rise, which considerably alter production and market-participation decisions. The majority of smallholder farmers are located in remote areas with poor transport and market infrastructures, contributing to the high transaction costs they are already facing. In addition, they lack reliable market information as well as information on potential exchange partners [18].

According to NAMBoard (2013), the volume of local produce entering the market declined significantly, however the market sourced all cabbages, beetroot and most tomatoes locally [21]. Although the production of tomatoes was almost adequate, there were incidences where imported produce was used to supplement supply. Fast moving commodities such as potatoes, carrots and onions were predominantly sourced from the Republic of South Africa (about 70% of local consumption) due to under production in Eswatini. This is particularly so because the majority of farmers that signed contracts have not been able to supply the market in accordance with these agreements. To stimulate growth through contracted farming, NAMBoard continues to establish strategies targeting to increase the number of farmers enrolled to ensure the production of critical mass and realisation of consistency of supply. This initiative aims to engage more farmers in commercial agriculture who yielded more than original targets into suitable and functional groups which will enhance training and support initiatives [9]. The import rate for vegetables continues to rise in Eswatini year after year, contractual farming is amongst possible alternatives to mitigate this increase. However, it is worth noting that NAMBoard contracted farmers continue to fail meeting their obligation as their supply not consistent as expected. Against this backdrop, this present study, therefore aims at assessing the factors that influence the

consistency of contracted smallholder vegetable farmers' supply to NAMBoard in Eswatini. The specific objectives of the study were: to determine the socio-economic characteristics of contracted smallholder vegetable farmers supplying to NAMBoard; to assess the factors influencing the consistency of contracted smallholder vegetable farmers supplying to NAMBoard, and to determine the challenges faced by the contracted smallholder vegetable farmers supplying NAMBoard.

## II. ROLE OF NAMBOARD IN VEGETABLE PRODUCTION IN ESWATINI

The National Agricultural Marketing Board (NAMBoard) is a parastatal organisation established under the NAMBoard Act of Parliament no. 13 of 1985. The NAMBoard facilitates in the agricultural production, processing, storage, transportation, distribution and sale of both baby and conventional vegetables. Its purpose is to simulate local production by providing technical service and the marketing of agricultural produce in the country and particularly to support the small farmer [21]. Currently, there are about 300 registered vegetable farmers [22]. In 2009, there were only 120 registered baby vegetable farmers mostly located in the rural areas. National Agricultural Marketing Board is divided into three sections; statutory which controls the importation of certain agricultural products into Eswatini, the Farm Support and Development Unit (FSDU) which helps small farmers to develop their businesses and Encabeni Fresh Produce which provides an outlet for the produce of Eswatini's farmers. Their core functions are to regulate imports and exports of agricultural products and goods in transit, to facilitate in such a manner as the Board considers appropriate production, processing, storage, transportation and sale of scheduled agricultural products, to advise government in all matters related to the availability and demand for scheduled products and lastly, to facilitate in the establishment of markets and marketing of locally produced scheduled products in the domestic and international markets.

The Farm Support and Development Unit (FSDU) facilitate a baby vegetable production project. The project supports farmers growing and exporting a variety of baby vegetables to Europe, South Africa as well as local market. A farm input shop which provides inputs to farmers at low cost plus a nursery is also available. The transport for collecting produce from the farm as well as to South Africa is provided at subsidized rates. Encabeni Fresh Produce Market, however, is situated along Mahlanya-Matsapha road and is a wholesale market that provides a full range of fresh fruits and vegetables. Where possible, all produce is bought from local farmers but some product lines have to be supplemented by selected imports from South Africa [21].

### Baby vegetables production in Eswatini

NAMBoard (2006) emphasized that quality baby vegetables command high prices which are justified

because of the high level of management and labour required in production and the relatively low yields obtained because of the small size of the harvested product [23]. The product should always be as uniform as possible, clean, free from damage and free from decay. Because of their size and value, baby vegetables are packed in relatively small baskets or cartons. Baby vegetables are more subject to post-harvest deterioration than their normal-size counterparts. If harvested too late, they become overripe and tough. Thus, it is extremely important to cool and hold miniature vegetables under recommended temperature and relative humidity conditions. Eswatini is regarded as a suitable producer of baby vegetables due to its four climate zones within a relatively small radius, enabling production of the entire range of baby vegetables all year-round [1]. According to Vilakati (2007), when choosing suitable market outlets, the following factors have to be considered; the volume of the produce you will be growing, the time you have available for marketing during the growing season, your willingness, time and ability to deal with customers directly, the perishability of your produce and finally, price levels and price stability of the market and barriers to market entry and expansion [4].

According to Monaren (2013), baby vegetables are high-value products trading at a premium price to traditional vegetables even though they are not produced in large quantities [24]. She further went on to state that baby vegetables yield a constant cash flow and that their prices are higher than those of conventional vegetables. The enterprise's profitability however, may be affected by the fact that the baby vegetable industry is faced with high input costs such as labour costs, seed, fertilizer, chemical and fuel costs as well as marketing costs. Also worth noting is that baby vegetables are expensive to farm since producers must invest in high capital infrastructure in order to supply them. Baby (petite, miniature, mini) vegetables are smaller versions of full-sized produce. Many baby vegetables are simply standard cultivars that are harvested at an immature age (e.g. baby corn) while others are cultivars that have been genetically developed to produce miniature vegetables (e.g. cherry tomatoes). Baby vegetables include green beans, baby corn, baby marrow, baby gem, baby cabbage (green), green baby patty pan, yellow baby patty pan and peas. Nxumalo (2008), states that baby vegetables were introduced by the Europeans to offer to the client's high nutritional plates of delicious taste [25].

Eswatini's climate offers an untapped business potential hence farmers can grow baby vegetables year-round for export. Eswatini's varied micro climates give it an advantage in producing certain high-value horticultural products such as baby vegetables. Dlamini (1999), states that production practices used for normal-sized vegetables are the same as those used for miniature vegetables exact for closer spacing and earlier harvest. Timeliness in harvesting is important, as baby vegetables can quickly grow larger than desired [26]. He further went on and

added that growing, harvesting and preparing of baby vegetables for export requires a great amount of hand labour because successful production requires a high level of attention and is not suited to mechanical agricultural techniques. Baby vegetables command a higher price than their ordinary counterparts due to their great demand.

### Vegetable marketing in Eswatini

Eswatini produces different types of vegetable crops in the various agro-ecological regions as a source of income and

food security. Table 1 shows the vegetable crop status of the most commonly produced vegetables in Eswatini between the years 2008 to 2012. During the period 2008 to 2012, a total of 559 farmers were involved in the production of cabbages, tomatoes, carrots and onions under a total area of 353.7 hectares. The total contribution of the vegetables to gross domestic product was E278,481 by 2012.

Table 1: Status for the most commonly produced vegetables in Eswatini between 2008 to 2012

Vegetable crop	Hectares	Number of farmers	Average returns/ ha	Cost of production(E)	Contribution to GDP
Cabbages	154.8	310	83,332	18,481	64,852
Tomatoes	72.5	145	105,000	22,602	82,398
Carrots	96.8	37	105,000	15,170	89,829
Onions	30.4	61	62,500	21,097	41,402
TOTAL	353.7	559	355,832	77,350	278,481

Source: NAMBoard (2012)[27]

For the past 15 years, the Government of Eswatini has been encouraging farmers to embark in baby vegetable production through the National Agricultural Marketing Board. This has been one of the efforts by government to encourage farmers to diversify crop production activities on their farms. Farmers have willingly taken up the practice of baby vegetable production as there are currently 120 registered baby vegetable producers in the country who are mostly located in the rural areas and cultivating on Swazi Nation Land [7]. The consumption of vegetables in Eswatini has been increasing over the years and the country is blessed with fertile soils which favour vegetable production [2]. Climate is important for crop production. The climatic conditions in Eswatini are favourable to produce a wide range of vegetables and water for irrigation is enough, though additional developments are still necessary [2].

Marketing is fundamental for the success of vegetable farmers and therefore, farmers rely on good infrastructure, appropriate transportation facilities, improved technology and communication links to effectively market their products. Market participation becomes more profitable if farmers are able to minimize transaction costs and produce goods and services at a lower opportunity cost [28]. Farmers can sell their vegetables through different marketing channels ranging from the farm gate, restaurants, wholesalers and supermarkets. The choice of an outlet may depend among other things on the agro-ecological location of the channels and whether the farmer is able to meet market requirements such as quality, safety standards and consistent supply.

Eswatini as a developing country requires an improved marketing system since the demand for vegetables is increasing very fast due to the growth in urban populations, opportunities to earn foreign exchange by exporting high value-off-season produce, offering better prices for products to small farmers and the contribution to employment made by its labour intensive production. Eswatini has a wide range of marketing systems including farmer markets, cooperative markets, contract markets and corporate markets. The interests of small-scale farmers are protected through farmer markets and cooperative markets, while the contract and corporate markets mostly cater for the commercial farms. The traditional markets found in most towns receive vegetables from local vendors who buy at the farm gate and deliver to the markets, however they choose to buy from bigger and more trustworthy farmers in South Africa due to the unevenly distributed areas of production and the unreliable of local supply produce [7].

### Contract Farming

Contract farming is an agreement between one and more farmer(s) and a contractor for the production and supply of agricultural products under forward agreements frequently at predetermined prices. It is a system for the production and supply of agricultural or horticultural produce under forward contracts between farmers and contracting company. The essence of such an arrangement is the commitment of the farmer to provide an agricultural commodity of a certain type, at a time and a price, and in the quantity required by a known and committed contracting company. Contract farming is a contract between a farmer and a purchaser established in advance of the growing season for a specific quantity, quality and date of delivery of an agricultural output at a price or price

formula fixed in advance. The contract provides the farmer with the assured sale of the crop and at times provides for technical assistance, credit, services, or inputs from the purchaser [12]. Thus, under contract farming the contractor supplies all the inputs while the farmer supplies land and labor.

### Importance of contract farming

Contract farming is an alternative method of farming, very useful in developing country like Eswatini. Farmer suffers from the problem of assured market, again agro-based and food industry requires inputs of good quality agricultural produce. Contract farming builds a bridge between the farm and the industry to fulfil their needs. It also provides a linkage between agriculture and processing industries. Private investment in agriculture will increase through contract farming and in consequence of that financial burden of central and state governments will be reduced. Farmers find a steady source of income through contract farming, not only that it will generate gainful employment in rural areas. Contract farming is needed to bring about a market focus in terms of crop selection by Indian farmers and to trim down migration of labor from rural areas to urban areas.

### III. METHODOLOGY

The study focused on vegetable farmers at Manzini region of Eswatini. These farmers were smallholders operating on a commercial basis and contracted to NAMBoard. Vegetable farmers from the Manzini region constituencies that are contracted to NAMBoard are 740 and 123 farmers were randomly sampled and interviewed for the study. A structured questionnaire was designed and used as a key instrument for data collection. Both qualitative and quantitative data was captured by the questionnaire. The multinomial logit model was used to analyse the factors influencing smallholder farmer's consistency supply of vegetables to NAMBoard. The dependent variable was coded as zero (0) = consistency (base), one (1) = partially consistent and two (2) = inconsistency. To analyse the challenges associated with the probability to supply the market inconsistently, the study made use of the logistic regression model.

Collected data was coded and entered into STATA version 14, for analysis. Both descriptive statistics and the multinomial logistic regression model (MNL) were used to analyse data that was collected from smallholder vegetable farmers. In this study it was hypothesized that smallholder vegetable farmers are faced with three choices; NAMBoard, informal local rural markets and non-market participation. It is assumed that these decisions are made based on the option that maximizes utility subject to technical, institutional and socio-economic constraints. The MNL model that was used in this study was adopted from [29-32]:

$$P_i = E(Y = X_i) = \frac{1}{1 + e^{-(\beta_1 + \beta_2 X_1)}} \quad (1)$$

Where  $P_i$  represents probability

The equation is written as equation (2) for ease of exposition

$$P_i = \frac{1}{1 + e^{-z_i}} = \frac{e^{z_i}}{1 + e^{z_i}} \quad (2)$$

Where  $z_i = \beta_1 + \beta_2 X_i$

$Z_i$  ranges from  $-\infty$  to  $+\infty$

$P_i$  ranges between 0 and 1 and is nonlinearly related to  $Z_i$

Linear Form of equation (1) presented in equation 3:

$$1 - P_i = \frac{1}{1 + e^{z_i}} \quad (3)$$

Therefore,

$$\frac{P_i}{1 - P_i} = \frac{1 + e^{z_i}}{1 + e^{-z_i}} = e^{z_i} \quad (4)$$

Taking the natural log of equation (4)

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = Z_i = \beta_1 + \beta_2 X_i \quad (5)$$

For estimation purposes equation (5) is written as follows equation 6:

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = Z_i = \beta_1 + \beta_2 X_i + \mu_i \quad (6)$$

$\ln\left(\frac{P_i}{1 - P_i}\right)$  logit for consistent participation to NAMBoard

$P_i$  = probability of participation to supplying NAMBoard

$1 - P_i$  = probability of not participation to supplying NAMBoard

$X_i$  = independent variables

$\beta_i$  = parameters to be estimated

$\mu_i$  = the error term

In the model, consistent participation to NAMBoard represents the dependent variable where non-market participation was set as the reference category. Participation to supplying NAMBoard was the ability to consistently supply NAMBoard. These are the channels that producers at any point in time could offer to NAMBoard. It followed that  $p_i$  represented the probability of consistency to supply NAMBoard and  $1 - p_i$  is the probability of being partially consistent to supply NAMBoard or not supplying at all. In other words, the model was used to assess the odds of supplying NAMBoard consistently as against partially supplying and not supplying at all.

### Description of variables used in the model

The independent variables that influence the consistent supply of smallholder vegetable farmers to market channels adopted from literature are shown in Table 5. Gender of the farmer was set as a dummy variable where female took the value of 1 and zero otherwise. It is assumed that male smallholder farmers tend to have better access to productive resources necessary to meet quality requirements hence they might have a wide option of marketing channel choices compared with their female counterparts.

Smallholder farmers' level of education can improve production and marketing practices. The higher the level of education, farmers is expected to have high productivity, engage in value addition activities and ultimately have diverse marketing channels [12].

According to Costales and Catelo, (2009) household size can be used as a proxy for available family labour that can be channel towards production activities [12]. Nonetheless, bigger household sizes may mean higher household consumption and reduced market surplus. Therefore, a

negative sign is expected if a household consumption leads to reduced market surplus. Conversely, a positive sign is expected if household size translates to more marketable surplus.

Table 2. Description of variables used in the model

Variable	Definition	Coding of Variable	Category	Expected Sign
X <sub>1</sub>	Gender	1 if female, 0 if male	Dummy	+/-
X <sub>2</sub>	Education level	1 if literate, 0 if illiterate	Dummy	+
X <sub>3</sub>	Household size	Number of family members	Continuous	+
X <sub>4</sub>	Age	Number of years	Continuous	+/-
X <sub>5</sub>	Farming experience	Number of years	Continuous	+
X <sub>6</sub>	Distance to market	Number of kilometers	Continuous	-
X <sub>7</sub>	Market information	1 if yes, 0 if no	Dummy	+
X <sub>8</sub>	Access to credit	1 if yes, 0 if no	Dummy	+
X <sub>9</sub>	Group membership	1 if group, 0 if individual	Dummy	+
X <sub>10</sub>	Producer Price	Price/ kilogramme	Continuous	+
X <sub>11</sub>	Extension	1 if yes, otherwise 0	Dummy	+
X <sub>12</sub>	Family labour	1 if yes, otherwise 0	Dummy	+
X <sub>13</sub>	Add value	1 if yes, otherwise 0	Dummy	+
X <sub>14</sub>	Road infrastructure	1 if good, 0 if poor	Dummy	+
X <sub>15</sub>	Quantity produced	Number of kilogrammes	Continuous	+

Age was measured in years of smallholder vegetable farmers. Age affects participation in markets through various ways such as experience, risk preference and access to resources [33]. Younger farmers are expected to be risk takers, innovative and to be involved in activities such as value addition so as to access other alternative markets. Alternatively, older farmers are expected to have gained experience and have access to resources [33]. Therefore, the expected sign might be negative or positive. Farming experience improves market participation of smallholder vegetable farmers through improved bargaining power in the output market and enhanced connection with traders such as middlemen. Experience was noted as a key factor which improves farmers' negotiation skills in the output market [33]. A positive sign is expected for this variable in this study.

Distance to market was measured in kilometers from the smallholder farmer production area to the market. Several studies have established the negative influence of distance on smallholder farmers' participation in markets [34]. The longer the distance from the farmer's production area to NAMBoard, the less likely the farmer is to participate in that particular marketing channel. This is because the farmer's profit returns are bound to be reduced as a result of increased transportation costs and the encountered opportunity cost of time. As such, a negative sign was hypothesized for this variable.

Access to market information was measured by the farmer's ability to access market information and the aptitude to interpret it correctly [35]. Farmers were interviewed with regards to communication channels available to them. Access to market information had been set as a dummy variable, where a farmer with access to market information took the value one otherwise zero. Access to market information was expected to influence market channel decisions positively. Access to credit may enable smallholder vegetable farmers to have increased output. Therefore, they can have bulk marketable surplus, which might enable them to participate in distant urban markets. The variable was measured as a dummy (1 if farmer had access, 0 if no). A positive correlation was expected for this variable.

Studies have highlighted the importance of smallholder farmers working collectively to access lucrative markets [33]. Farmers were interviewed whether they belong to a farmer group or they operate individually, the responses were allocated dummy values. Group marketing is anticipated to impact positively on market participation and choice of marketing channel amongst smallholder farmers.

Producer price denoted the price offered by a particular vegetable marketing channel. Farmers spend a considerable amount of resources and time searching for markets which offer lucrative prices. A marketing channel offering higher price is likely to act as an incentive for

farmers to participate in that particular marketing channel [33]. Therefore, a channel offering a better price was hypothesized to have a positive effect on the selection of that particular marketing channel.

Access to extension services conveys knowledge, market information and technical skills to smallholder vegetable farmers [33]. This was also very important for smallholder vegetable farmers to participate in marketing channels that offer higher premiums. Dummy values was allocated to this variable, farmers with access to extension services was taken the value of one and zero if otherwise.

Closely related to household size was the issue of family labour. Farmers were asked whether they had adequate family labour for vegetable production or not responses were assigned dummy values. Availability of adequate family labour was expected to boost productivity and increase marketable surplus. Thus, a positive relationship was expected for this variable.

To analyze the challenges associated with the probability to supply the market inconsistently, the study made use of the logistic regression model. Logistic regression is based on binomial probability theory. It is a mathematical modeling approach used in describing the relationship of several independent variables to a dichotomous dependent variable or a limited dependent variable. The logit function was employed because the dependent variable 'default' is dichotomous, whereas the proposed covariates were mixture of continuous and categorical random variables. Thus the model was chosen over others due to the data structure and purpose. Also the independent variables need not be interval, or normally distributed, nor linearly related, nor equal variance within each group. The logit model is a derivative of the odds function. The odd of a function is the ratio of the probability of success to that of failure. Thus,

$$Odds(Y = 1) = \frac{P(Y=1/X=x)}{P(Y=0/X=x)}$$

Where *Odds* ( $Y = 1$ ) is the odds of supplying the market inconsistency; ( $Y = 1$ ) is the probability that inconsistent supply occurs given a set of explanatory variables and ( $Y = 0$ ) is the probability of consistent supply given a set of explanatory variables. If the odds of inconsistent supply is greater than one, it means there is a higher probability of inconsistently supplying the market compared to that of consistently supplying the market. A value less than one indicate a higher probability of consistent supply than that of inconsistent supply. Given the binary response variable (inconsistent supply or consistent supply), the probability distribution of the number of defaults in a given loan portfolio size, for given values of explanatory variables is binomial.

The Maximum Likelihood Estimates (MLE) is the empirical estimation of logit model; it assumes large sample properties of efficiency, consistency, normality of parameter estimates and validity of the t-test significance. Beside these properties, the logit model could help to avoid the major problem associated with Ordinary Least Square (OLS) which estimate the standard linear probability model. The MLE coefficient estimates from the logit analysis have no direct interpretation with respect to the probability of the dependent variable (inconsistent supply =1) other than indicating a direction of influence of probability.

This methodology also expresses the linear regression equation in logarithmic terms. The relative effect of each explanatory variable on the likelihood that the farmers will inconsistently supply the market:

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k$$

If  $p$  is the proportion of observations with an outcome of 1, then  $1-p$  is the probability of an outcome of 0.

**Inconsistent market supply** = Whether or not the farmers consistently or inconsistently supplied the market (measured as a dummy, 1 non-consistent and zero otherwise). This is the dependent variable.

Variable	Definition	Coding of Variable	Category
X <sub>1</sub>	Access to seed	1 if yes, otherwise 0	Dummy
X <sub>2</sub>	Access to fertiliser	1 if yes, otherwise 0	Dummy
X <sub>3</sub>	Access to seedlings	1 if yes, otherwise 0	Dummy
X <sub>4</sub>	Fluctuation of input prices	1 if yes, otherwise 0	Dummy
X <sub>5</sub>	Distance to market	1 if yes, otherwise 0	Dummy
X <sub>6</sub>	Access to market information	1 if yes, otherwise 0	Dummy
X <sub>7</sub>	Low market demand	1 if yes, otherwise 0	Dummy
X <sub>8</sub>	Lack of produce storage	1 if yes, otherwise 0	Dummy
X <sub>9</sub>	Shortage of labour	1 if yes, otherwise 0	Dummy
X <sub>10</sub>	Shortage of farmland	1 if yes, otherwise 0	Dummy

#### IV. RESULTS AND DISCUSSIONS

##### Socio-economic characteristics of farmers

Table 3 below shows the descriptive statistics of the farmers' socio-economic characteristics in the study area. The study found out that the majority of households in the

study area were male-headed (66.2%) and having at least attained some high school education (60%). Further, Table 3 shows that 14.6% of the SME owners have a number of dependents ranging from zero to four (0 – 4), while 77.5% of them have a number of dependents ranging from five to nine (5 – 9). According to Costales and Catelo

(2009), literacy level of smallholder farmers and middlemen is very important as it allows for better flow of product information and knowledge within the value chain [12]. Therefore, more efforts still need to be done to

provide tertiary education to vegetable farmers. The majority of interviewed vegetable farmers were married (74.5%).

Table 3: Summary of Social and Demographic Characteristics of the Respondents

Variable	Statistics
<b>Respondents' age (mean)</b>	50
<b>Respondents' gender (% of sample)</b>	
Male	66.2
Female	33.8
<b>Respondents' education level (% of sample)</b>	
No formal education	12.2
Primary school	18
High school	59.8
Bachelor's degree	10
<b>Respondents' marital status (% of sample)</b>	
Single	13.4
Married	74.5
Divorced	3.8
Widowed	8.3
<b>Respondents' family size (% of sample)</b>	
0 – 4	14.6
5 – 9	77.5
10 – 14	7.9

Source: Own survey

#### Factors influencing the consistency supply of vegetables to NAMBoard by smallholder farmers

A multinomial logit model was used to elicit the factors influencing consistency supply of vegetable to NAMBoard by smallholder farmers and the results are presented as follows:

##### Gender

The multinomial logistic model results confirm a negative and significant relationship between smallholder farmer's gender and partially consistent participation at 5% significant level. It could mean that in comparison to consistent participation, male headed households are more likely to be partially consistent instead of being non-consistent. This implies that female headed horticultural households are less likely to be partially consistent in relation to consistency in participation compared to their male counterparts. The observed negative relationship

between gender and partially consistent participation may be explained by the differences in resource endowments critical for accessibility to NAMBoard.

##### Distance to NAMBoard

Results presented in Table 4 indicate that distance to market had a negative sign for non-consistent participation and was statistically significant at 5% level. These findings suggest that an increase in distance to NAMBoard reduces the possibility of farmers' non-consistency in supplying the vegetables to NAMBoard and rather opt for partially constant participation. The results are inconsistent with a *priori* expectations. On the other hand, partially consistent participation had a positive coefficient and was statistically significant at 1% level. The results are contrary to findings of previous studies which establish that distance negatively influences smallholder farmers' participation in supplying markets [34].

Table 4: Multinomial logistic regression results

Variable	Non-consistent			Partially-consistent		
	Coefficient	SE	Significance	Coefficient	SE	Significance
Gender	0.425	0.361	0.240	-1.491	0.707	0.035**
Education	-0.424	0.341	0.215	-0.395	0.544	0.468
Household size	0.041	0.320	0.899	-0.709	0.575	0.218
Age	-0.328	0.396	0.407	-0.490	0.658	0.456
Farming experience	-0.253	0.354	0.475	-0.731	0.659	0.267
Distance to market	-0.897	0.390	0.021**	3.428	0.744	0.000***
Market information	-0.506	0.610	0.407	0.998	0.345	0.004***
Access to credit	0.501	0.570	0.380	0.234	0.881	0.791
Group membership	1.021	0.435	0.019**	2.920	0.906	0.001***
Market Price	0.041	0.569	0.942	0.772	0.388	0.047**



Extension	0.299	0.545	0.584	-1.859	1.433	0.195
Family labour	-0.546	0.335	0.103	0.352	0.552	0.524
Add Value	-3.035	0.592	0.700	3.835	0.779	0.000
Road infrastructure	-0.784	0.375	0.037**	1.815	0.674	0.007***
Quantity produced	2.123	0.456	0.000***	2.864	0.592	0.000***
Market Infrastructure	-1.475	1.124	0.190	1.476	0.748	0.549
Intercept	4.966	1.223	0.000	2.630	1.736	0.130

Significance level at \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

- a) Base Category = consistent participation  
 b) No. of Observations = 123  
 c) Pseudo R -Squared = 64.15

### Market information (about NAMBoard)

Access to market information had a positive sign for partially consistent participation as shown in Table 4, which is consistent with the *a priori* expectations. The coefficient for market information about NAMBoard was significant at 1% level for partially consistent participation. This suggests that availability of market information improves the likelihood of a contracted farmer to supply NAMBoard. Market information enables smallholder vegetable farmers to align their production as well as their marketing systems in tandem with the demands of NAMBoard. Therefore, this reinforces the notion that availing market information enhances smallholder farmers' productivity. These results support previous empirical studies that availability of market information plays an important role in consistent participation of smallholder farmers [35].

### Group membership

With reference to group membership, it had a positive sign for both non-consistent and partially consistent participation, which was in line with the *a priori* expectations or partial consistent but inconsistency with *a priori* expectation for non-consistent. The significance p-values of 0.019 for the non-consistent participation and 0.001 for the partially consistent participation imply that group membership increase either of the two participation categories, see Table 4. This result provides a mixed conclusion. Group participation enables smallholder vegetable farmers to improve partially consistent supply to NAMBoard which they might find difficult to consistently supply individually. However, the positive relationship between non-consistent supply and group membership indicate that some groups prefer selling to other markets rather than NAMBoard. The results of the model therefore emphasize the need to upscale group participation of smallholder vegetable farmers for them to consistently supply NAMBoard on a contract. These findings are consistent with numerous studies which emphasise the importance of smallholder farmers working collectively to consistently supply markets. These findings still support findings of Makhura et al. (2002) who suggest that smallholder vegetable farmers in groups were less likely to be consistent in supplying markets [34].

### Road infrastructure

Road infrastructure had a negative and significant coefficient for non-consistent participation, it also had positive and significant coefficient for partially consistent participation as expected. Both non-consistent and partially consistent participation had significant P-values of 0.037 and 0.007, respectively. A positive relationship between the variables confirms the hypothesis that good road conditions have a positive influence on consistency by smallholder vegetable farmers. However, the majority of farmers in the study area were bemoaning the need for feeder roads that link them to major highways that connect to NAMBoard to be maintained. They stated that this will minimise spoilage of their vegetables during transportation as well as reduce their effort in accessing NAMBoard.

### Quantity produced

The coefficient of quantity produced was statistically significant (0.000) and positive for both non-consistent and partially consistent participation. The positive sign emphasises the importance of quantity produced in determining the likelihood of consistency of the contracted farmers in supplying NAMBoard for partially consistent farmers while the non-consistent will source for other markets that may offer better prices for their good quality output. This is because smallholder vegetable farmers in the study area like everywhere else in the country establish their businesses as a means of survival. Hence, they might need to satisfy household consumption requirements first, before engaging in the decision to supply markets. Thus, the decision to supply markets is conditional on surplus quantity produced. These observations support the notion that smallholder vegetable farmers will be willing to travel long distances to consistently supply their markets depending on the amount that they will have produced.

### Market Price

The multinomial logit model results presented in Table 3 indicate that producer price had positive and significant relationship with partially consistent participation at 5% level. The significant value of (0.047) implies that the contracted farmers tend to be guided by market price for them to consistently supply NAMBoard. Farmers that tend to receive higher prices from NAMBoard are partially consistent. The value of the odds ratio (0.462) reinforces this observation that market price influence consistency of

the farmers. It shows that as market price increases, there is a 46.2% chance that smallholder farmers will fall in the partially consistent participation category than falling into the consistent participation category. If smallholder farmers are assured of a good market price they are willing to partially participate in supplying NAMBoard, rather than settling for not participating at all.

### Challenges associated with the probability to supply the Market inconsistently

Table 5 below presents the major constraints that contribute to inconsistent market supply as perceived by the farmers. Access to seed, Access to fertiliser, Access to seedlings, Shortage of farmland and Lack of produce storage as major constraints perceived by the farmers are positively associated with the probability to inconsistently supply the market.

Table 5: Major constraints that contribute to inconsistent market supply

VARIABLE	Odds Ratio	Std. Err
Access to seed	1.84*	0.644
Access to fertiliser	1.14***	0.043
Access to seedlings	4.98***	2.18
Fluctuation of input prices	0.312	0.261
Distance to market	3.52*	1.96
Access to market information	2.03	0.957
Low market demand	3.86	3.22
Shortage of labour	2.04	1.30
Lack of produce storage	4.68*	4.33
Shortage of farmland	7.25**	5.70

Significance level at \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

If a farmer perceives access to seed as a major constraint, the odds of inconsistently supplying the market are 2.26 times larger than the odds of consistently supplying the market. Access to fertiliser perceived as a problem was found to increase the probability to inconsistently supplying the market (odds ratio  $> 1$ ). This implies that the farmers that experiences difficulties in accessing fertiliser are more likely to inconsistently supply the market than to consistently supply the market. The results show that farmers that perceive access to seedlings; shortage of farmland, and lack of produce storage are more likely to inconsistently supply the market (odds ratio  $> 1$ ) than to supply the market consistently. Access to seedlings as a major constraint is found in positive association with the likelihood to supply the market inconsistently and statistically significant at 1% level of significance. Holding other factors constant, its odds ratio (4.98) result indicates that the probability of the farmers to supply the market inconsistently is 4.98 times higher than that of supplying the market consistently. Lack of produce storage perceived as a major constraint is found positive and statistically significant at 1% level of significance. Its odds ratio shows that the probability of the farmers to supply the market inconsistently is 4.68 times higher than that of supplying the market consistently. Shortage of farmland perceived as a major constraint is found positive and statistically significant at 1% level of significance. Its odds ratio shows that the probability of the farmers to supply the market inconsistently is 7.25 times higher than that of supplying the market consistently.

### V. CONCLUSION

The main objective of the study was to assess factors that influence the consistency of smallholder vegetable farmers in the Manzini region in supplying NAMBoard. Results from the multinomial logistic regression model suggest that distance to NAMBoard negatively and significantly influence non-consistent participation of the farmers to supply NAMBoard. Thus, there is a need for NAMBoard to decentralise its services closer to farmers where possible. Group membership, road infrastructure and quantity produced positively and significantly influence smallholder farmers' non-consistent participation. The positive relationship of these variables and non-consistent frustrate efforts of NAMBoard organising farmers in groups and trainings for improved quality because when more farmers join groups and produce quality products they find alternative markets thereby becoming non-consistently supplying to NAMBoard. Therefore a need for improved enforcement of contracts signed between farmers and NAMBoard. Distance to NAMBoard, market information, group membership, market price, road infrastructure, and quantity produced positively and significantly influences smallholder farmers' partially consistent participation. This result indicate that more efforts needed to promote or enhance market information, group membership, increased market price as an incentive, building good roads, and training farmers on producing quality products may lead to improved consistent supply of vegetables to NAMBoard by contracted smallholder farmers. Furthermore, despite vegetable production being deemed a "women crop" the study revealed that males were more likely to participate in supplying NAMBoard than their female counterparts. Thus, to ensure consistent

NAMBoard should solidly depend on men led market although women also need empowerment to improve on their consistent supply of vegetables to NAMBoard.

### Recommendations

The study therefore recommends: gender sensitive policies can be affected by considering the following: There is need to research further ways of capacitating women smallholder farmers to produce high value horticulture products which are required in formal markets and ultimately for export. In-order to reduce exploitation of women smallholder vegetable farmers by formal markets there is need for policies that enforce proper grades and standards in markets. It is also important for policies to give cognizance of different time variations between men and women when producing their vegetables. Gender sensitive extension should be promoted that deliberately seek to give women smallholder vegetable farmers' leadership roles in cooperatives and irrigation schemes. Extension can also tap into the use of information and communication technologies (ICTs) to provide market information that focus on smallholder female farmers' needs. In the same vein, awareness should also be extended to men so that they understand the importance of gender equality in vegetable production and marketing. Group membership was found to have a positive effect towards partial consistency of farmers. Thus, there is need for crafting of appropriate policies and programmes which foster collective action amongst smallholder vegetable farmers. This can be attained through public private partnerships (PPP) from various stakeholders such as government, private sector and Non-Governmental Organisations. They can assist in offering institutional support so that smallholder farmers can consistently participate in lucrative formal markets. It is recommended that farmers should form partnerships for them to be able to supply formal markets. Such partnerships will also enable them to supply the required volumes and guarantee consistency. Therefore, group participation and cooperatives in production and marketing might be beneficial innovations for smallholder vegetable farmers. Although cooperatives and smallholder farmer groups had their own challenges in the past, nonetheless, these can be circumvented by coming up with mechanisms that foster trust, commitment and collaboration amongst smallholder farmers. Finally, there is an urgent need for government to invest in improving road infrastructure particularly feeder roads that link farmers to major high ways. This can minimise transaction costs of smallholder vegetable farmers. Hence, they will be able to consistently supply formal markets.

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