

**ANALYSIS OF THE DYNAMICS OF GOVERNMENT-SUPPORTED SMALLHOLDER
BABY VEGETABLE ENTERPRISES FOR AN INTERGRATED HIGH-VALUE
DEVELOPMENT FRAMEWORK**

By

**Dlamini, Del'sile Daisy Masika
(Student Number: 17023790)**

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School of Agriculture**

SOUTH AFRICA

Supervisor : Prof. J. Zuwarimwe

Co- Supervisor (s) : Prof. J. Francis

: Prof. G.R.A. Mchau

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DECLARATION

I, **Dlamini, Delsile Daisy Masika**, hereby declare that this thesis for Doctor of Philosophy in Rural Development (Ph.D. RDV) submitted to the Institute for Rural Development at the University of Venda has not been submitted previously for any degree at this or another university. It is original in design and execution, and all reference material contained therein has been duly acknowledged.

Signature :



Date : 20/5/23

Dlamini Delsile Daisy Masika

ABSTRACT

The government of Eswatini embraces the integration of smallholder farmers into high-value crop production as a vehicle for inclusive green growth. However, the outcome of the sector remains low and hampers its contribution towards this goal. The study assessed the levels of technical, allocative and economic efficiencies within the production processes. The study further analysed the levels of financial literacy among smallholder farmers. The challenges encountered by farmers were also characterised and strategies towards the integration of smallholder farmers into high-value crop production were suggested. A cross-sectional design that employed sequential mixed-methods approach was adopted and purposive sampling was applied to the selected a group of farmers from the Manzini and Hhohho regions. Data were collected through a structured questionnaire, key informant interviews and focus group discussions. The data were analysed through the SFA, discriminant and thematic analyses methods. Triangulation enabled synthesis of results for the proposed integration framework. Farm characteristics showed that age, gender, education, and labour cause variation in the group. Efficiency analysis showed that technical, allocative, and economic efficiencies were 52%, 53% and 29%, respectively. There were 88% respondents with below 50% economic efficiency, indicating low profit rates for sustainable production. High harvesting labour costs, overuse of fertiliser with unoptimized land size were significant sources of inefficiency among farms. The enterprises were largely affected by production and marketing risks. Low product quality and delayed cash inflows affect liquidity of farms, while weather variability and unavailability of labour during harvesting induced crop losses that undermined farmers' economic returns. Growers use non-saving financial services and have unsatisfactory financial literacy that led to poor financial performance. The non-saving culture encouraged the use of costly capital to finance production processes. Proposed is a three-pillar framework for the integration of smallholder farmers into high-value vegetable production. The pillars include building capacity for improved technical and allocative efficiencies, strengthening sector risk management plan, and enhancing farmer financial literacy. Skills development and creation of innovation can be ameliorated through the promotion of youth engagement in agribusiness and improvement of extension services to create demand for agricultural financial services. This is imperative for improved farmers' production capacity and increased marketed share, thereby, promoting rural development through profitable high value crop production.

Keywords: efficiency, financial literacy, financial inclusion, constraints, farm risks, financial literacy, farm enterprises

DEDICATION

To my late mother, in recognition of all the encouragement and investment she made into building my life.

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ABBREVIATIONS

AAF	African Agricultural Fund
ADB	African development Bank
CADDP	Comprehensive Africa Agriculture Development Programme
CASP	Comprehensive Agricultural Sector Policy
CFA	Contract Farming Arrangements
DEA	Data Envelopment Analysis
FAO	Food and Agricultural Organization
FDG	Focused Group Discussions
FIF	Financial Inclusion Framework
IAD	Institutional Analysis and Design
IFAD	International Fund for Agricultural Development
IVCD	Inclusive Value Chain Development
KPA	Knowledge, Attitude and Practice
MPA	Multivariate Probit Analysis
NAMBoard	National Agricultural Marketing Board
NEPAD	New Partnership for Africa's Development
PG	Producer Groups
PSM	Propensity Score Matching
RDA	Rural Development Area
RWA	Rural Web Analysis
RWVC	Rural Web Value Chain
SHIS	Smallholder Irrigation Schemes
SMLPP	Smallholder Market Led Production Programme
ENL	Eswatini Nation Land
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNIDO	United Nations Industrialization Development Organization
VC	Value Chain
VCD	Value Chain Development
WEF	World Economic Forum
WFP	World Food Program

CHAPTER 1 INTRODUCTION

1.1 Background

In most developing countries, agriculture remains the primary source of livelihoods and employment opportunities. The World Bank (2019) reported that an increase by one unit of investment in agriculture would triple the marginalised community's income. Poverty alleviation attributes have justified investment in agriculture to be crucial as it pulls more people out of poverty than investment in other economic sectors (Diao *et al.*, 2018). Therefore, the smallholder agriculture sector's development is seen globally as a sustainable and inclusive rural transformation strategy. An approach embedded with a general shift in agricultural product demand from basic food needs to quality market-driven agriculture products required to meet the demand of the growing middle-class and urban populations.

Meeting the growing demand for food markets requires collaboration among multinational agribusinesses and small-scale farmers (IFAD, 2016). The inclusion of smallholder farmers in the export markets can potentially catalyse their transition from subsistence production to commercialisation. The high price stimulus in the international market may trigger the desire by smallholder farmers for commercialisation. Such incentives could catalyse the smallholder farmers' desire to produce for export markets to benefit from better prices, thereby pulling them out of poverty.

Through the 2014 Malabo Declaration, African governments committed themselves to reduce poverty through inclusive agricultural growth and transformation. The statement emphasises the need to establish and strengthen inclusive public-private partnerships to support the agricultural value chain and promote shared prosperity and improved livelihoods. In Agenda 2063 of the African Union Commission (2015), Aspiration 1 outlines the importance of radically transforming African agriculture for making the continent a net food exporter and fostering inclusive prosperity for all. The United Nations Zero Hunger Challenge (2012) sought to increase the small-scale producers' income by a hundred per cent and regard small-scale farmers as key players in sustainable feeding.

Developing countries believe that increased agricultural production can alleviate poverty by generating employment opportunities in the agriculture sector (Hernández-Mogollón *et al.*, 2011; Maertens & Swinnen, 2009). What is envisioned is that interventions to promote smallholder farmers' participation in high-value non-traditional crop production and exportation would improve rural livelihoods and reduce unemployment and poverty (Afari-

Sefa, 2010). However, the success of such inclusive economic opportunities and rural employment chances in Africa is anchored on systematic and well-integrated interventions (African Development Bank [ADB], 2014).

The African Agricultural Fund [AAF] (2010) technical assistance facilitates the plans by IFAD, EU, and TechnoServe is a collaborative partnership to improve smallholder farmers' access to adequate and appropriately priced inputs and services in Africa. This fund also aims to improve smallholder farmers' productivity and enhances their financial returns. The New Partnership for Africa's Development [NEPAD] (NEPAD, 2014) also supports investment in inclusive agriculture and smallholder farmers' commercialisation through the Comprehensive Africa Agriculture Development Programme [CAADP] (NEPAD, 2014). Since the CAADP's inception in 2003, there have been concerted investments to stimulate growth in the agricultural sector. Growth prompted through private and public partners at continental, regional, and national levels to increase financing, promote coordination, share knowledge, and encourage joint efforts is noticeable. In the CAADP Results Framework (2015-2025) Levels 2 and 3 sought to rump up the agricultural transformation and sustained inclusive growth through increased productivity, expanded local agro-industry, and inclusive value chain development (NEPAD, 2014). Inclusive agriculture can improve people's wellbeing through proffering sustainable livelihoods (UN, 2012).

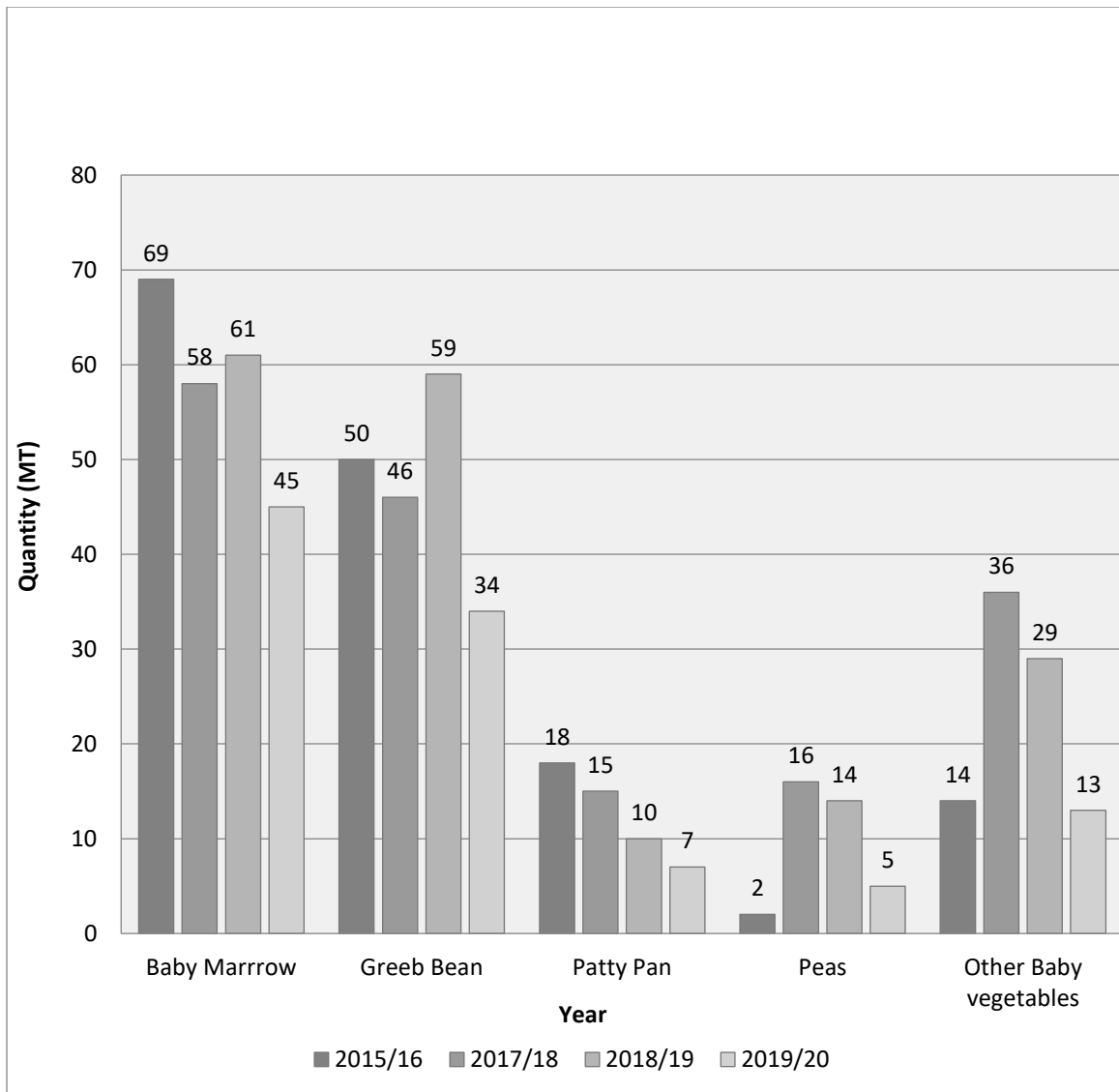
Agricultural transformation has been a catalyst of the smallholder farmer market integration process presented in Porter's value chain approach (1985). This transformation would lead agribusinesses to improve their position to supply global and local markets. It is driven by interventions anchored on linkages between these activities to give a competitive advantage (FAO, 2015). The value chain and smallholder farmer inclusion theory have been used to justify huge investments directed at intensifying agricultural production and linking smallholder farmers to export markets (Altenburg, 2006). The World Economic Forum [WEF] (2015) has also emphasised the need for raising the productivity of small-scale farmers' production as a key to sustainable, inclusive growth of African economies.

Public policies should be able to identify small-scale farmers as a part of a broader development solution at the country level. The target is to stimulate the dynamism within the farm sector as well as enhance the dynamic interactions and integration of the industry into the rest of the economy (Gatzweiler & Braun, 2016). The likelihood of smallholder export market participation is high among farmers who are already participating in local markets (Bobojonov *et al.*, 2016). There is, however, stagnant growth in smallholder market

participation in most sub-sectors, especially in high value cropping in Africa (Olwande *et al.*, 2015), such that, retaining one's position in a market requires productive investment and efficient management of transaction costs along the value chain (Romero & Wollni, 2015; Change, 2016). This study undertook a commodity systems analysis of the emerging baby vegetable value chain in the Kingdom of Eswatini.

In 1985, the Eswatini government established the National Agricultural Marketing Board (NAMBoard) to help in the agricultural market and trade controls. However, it was only in 1996 that NAMBoard embarked fully on promoting smallholder farmer integration in horticulture production. Through the Smallholder Market Led Production Programme (SMLPP), the government collaborates with non-governmental organisations and the private sector. The aim of this collaboration is to strengthen linkages that provide market information and extension, secure markets, enable business planning, and relations between buyers and producers (IFAD, 2015). The government also launched the Comprehensive Agricultural Sector Policy (CASP) in 2005, which guides the development of the sector.

The Government of Eswatini is also a signatory to the CAADP and has developed a detailed Agricultural Strategic Plan (2014-2019). The CAADP Results framework (2015-2025), is aligned to the Eswatini National Agricultural Investment Programme (2015), which supports the 1997 - 2022 national plan. The strategic plan and investment portfolio appeal for sustainable socio-economic development by providing services that enhance agricultural commercialization. It aims to improve productivity on customary land tenure and promotion of irrigated farming. The government offers extension services; the retailers make their market demand known to the producers regarding quantity, quality, time, and producer organization to serve this market (IFAD, 2015). The government of Eswatini launched the smallholder baby-vegetable production sector in 2003. Baby Vegetables are defined as immature miniature crops cultivated for perfection and picked before they are fully grown (AgriSETA, 2018). They are as nutritious as regular-size vegetables but have a tender with delicate taste and are highly perishable. These are produced solely for the export market, and growers are producing on customary tenure, known as the Eswatini Nation Land [ENL] (NAMBoard, 2009). The prospects to produce baby vegetables in Eswatini are excellent, both as an export earner and a conduit for improving rural households (Langwenya, 2014). Figure 1.1 shows supply trend of baby vegetable crops supplied by local growers from 2015/2016 to 2019/2020. According to the EU (2020) , smallholders supplying NAMBoard export the produce primarily to the EU and South Africa.



Source: National Marketing Board annual report (2019/2020)

Figure 1. 1: Baby vegetables Supply from Local Growers

Baby vegetables are considered one of the high-value export products. Baby vegetable production is profitable even on a small-scale (Langwenya, 2014), and is therefore suited for the average of three hectares of rural landholding in Eswatini (Sihlongonyane & Masuku, 2014). NAMBoard estimates that the baby vegetable business will earn at least US\$4 million in foreign exchange and provide employment opportunities and markets for local farmers (NAMBoard, 2016). This agriculture subsector is the second most important means of diversification of the country's agricultural sector for rural household income diversification after the sugarcane production subsector.

1.2 Statement of the Research Problem

Central to Africa's development agenda 2063 is agriculture for the facilitation of inclusive and sustainable economic development in member countries [African Union (AU), 2020]. The sustainable goal 1 on no poverty and goal 2 on zero hunger interlinks with goal 8 on decent work and economic growth, where export opportunities for smallholder products could fast track the attainment of these goals. Opportunities under the African Free Trade Area (AfCTFA) provide for the growth of the agricultural product export markets. The AU emphasizes that built capacity in food production could triple trade in agricultural products and services and encourage intra-African trade (AU, 2020). Moreover, baby vegetable exports could grow benefits from advantages that Eswatini has in preferential trade agreements with United States and the EU markets (EU, 2020).

Baby vegetables fetch high-value prices in foreign trade (Sikora *et al.*, 2019). Through NAMBoard, the Eswatini government has assisted Eswatini farmers in growing these vegetables (Xaba & Masuku, 2012). As a delicate crop, demanding adherence to the export markets' high-quality standards, the government and partners are collaborating to build the capacity of the marginalised rural farmers' livelihoods through the production of these crops. As part of its diversification strategy, the MoA has for the past 15 years continued to encourage the production of baby vegetables through NAMBoard. Xaba and Masuku (2013) reported that in 2009, about 120 baby vegetable smallholders on SNL were registered to supply NAMBoard. Growth and productivity in this industry is still low.

The Kingdom's Strategic Roadmap 2019-2022 emphasizes commercializing the agricultural sector and aligning the country toward an export-driven economy. The goal is to shift smallholders from subsistence farming toward commercial farming (GoE, 2019). This requires improving the integration and participation of small holders in markets. Improving productivity in niche markets for high-value horticulture crops such as baby vegetables have the potential to achieve this vision (Mangwe *et al.*, 2020). According to NAMBoard, baby

vegetables are one of the leading crops dominating the export market (NAMBoard, 2021). Thus, producing more baby vegetables would reduce high import rates and increase the country's foreign capital and smallholder income returns.

However, since baby vegetable inception in 2003, when NAMBoard began promoting baby vegetable production for the export markets, the production of baby vegetables has been declining. Presenting that local baby vegetable production has not met market demand. The market target from the baby vegetable farmers for the export market was thirty tonnes a week (NAMBoard, 2014), but only 10 tonnes a week was delivered, translating to a shortfall of 20 tonnes a week (TechnoServe, 2014), while in 2020 the supply fell to two tonnes of baby vegetables annually below the demanded target (NAMBoard, 2021). This is in spite of Eswatini's cheap and abundant supplies of unemployed labor and favorable climate providing a comparative advantage for the crop (WB, 2011). Baby vegetables can be grown all year-round in the Manzini and Hhohho district and with irrigation in all four agroecological zones to supply the market throughout the year (Mangwe *et al.*, 2020).

Low performance in the baby vegetable industry is a cause for concern because rural smallholders are losing the income and employment potential of this untapped industry and rural community development. Baby vegetables are not just income earners, but essential sources of quality nutrients key to achieving the SDGs related to food and nutrition security (Schreinemachers *et al.*, 2018). Furthermore, the number of smallholder farmers participating in the subsector has been decreasing. In 2009, there were 120 contracted smallholder baby vegetable growers (Xaba & Masuku, 2012), but in 2014 the number of baby vegetable farmers had dropped to 71 (Langwenya, 2014). On support to local employment, the EU (2020) reported that 700 families and seasonal workers benefit from producing and exporting baby vegetables to the EU market. This attrition was observed despite the continued investment made to support those who want to participate in the baby vegetable production. In 2010, the Food and Agricultural Organization (FAO) partnered with the government and invested 14.2million Emalangeni (1USDollar = 6.5875 Lilangeni) to support the programme (FAO, 2010). In 2012, USD42 million (1USDollar = 8.4754 Lilangeni) was invested by the International Fund for Agricultural Development (IFAD, 2012) in the Smallholder Market Led Production Programme (SMLPP) to support market-led smallholder farmers' development through the improvement of their productivity. The aim of the financial investment was to build capacity through extension, improve market supply as well as the development of irrigation infrastructure.

Smallholder baby vegetable farming, as a beneficiary of the SMLPP, aims to promote farmer participation in the high value crop production. Production of these miniature crops is characterised by the products' sensitivity to growth factor changes and high-quality demand. It requires investments on growth factors, adoption of market standards as well as ability to provide for smoothening changes that threaten economic benefits. The current low market delivery level suggest that the initiative has not yielded the desired results, particularly on smallholder grower capacity to produce for this market. Therefore, this study investigated the government-supported baby vegetable farming in Eswatini to establish smallholder enterprise efficiency, financial decisions, risk and challenges at the farm level that contribute to the sector's low production and sustainability.

1.3 Objective of the Study

The main objective of the study was to investigate the production dynamics of the government-supported smallholder baby vegetable farming in Eswatini and to develop an integrated smallholder farmer high-value production framework.

Three specific objectives and the questions were adopted.

- A. To establish the level of production efficiency of smallholder farm enterprises.
 - I. What are the characteristics of the baby vegetable farming systems?
 - II. What are the levels of technical and allocative efficiencies?
 - III. What are the factors affecting farm technical and allocative efficiencies?
- B. To characterize the challenges of venturing into smallholder baby vegetable production.
 - I. To determine the risks associated with smallholder baby enterprises.
 - a. What are the significant risk factors associated with smallholder baby vegetable enterprises?
 - II. To establish smallholder baby vegetable enterprise constraints to production and supply.
 - a. What are the constraints to smallholder farm production and supply?
- C. To assess financial literacy levels of smallholder farmers.
 - I. What is the level of financial inclusion among smallholder farmers?
 - II. What is the level of financial literacy of smallholder farmers?
 - III. What are factors influencing the financial literacy of smallholder farmers?

1.4 Research Hypothesis

Six hypotheses were considered to bring forth the results of the study.

H₀₁: there are no production inefficiencies in smallholder baby vegetable production (private and irrigation schemes).

H_{a1}: there exist production inefficiencies in smallholder baby vegetable production (private and irrigation schemes).

H₀₂: smallholder farm enterprise risk exposure is homogenous (private and irrigation schemes).

H_{a2}: smallholder farm enterprise risk exposure is not homogenous (private and irrigation schemes).

H₀₃: smallholder baby vegetable farmers do not have adequate financial literacy.

H_{a3}: smallholder baby vegetable farmers have adequate financial literacy.

1.5 Rationale of the Study

The smallholder baby vegetable subsector is government-driven vegetable production system that produces highly perishable produce for the export market. It provides an opportunity to study the net returns, efficiencies, risk exposure probabilities, and constraints to enterprise management. Concerning the financial integration aspect of the producers, it expands the understanding of smallholder financial inclusion and literacy levels on how they influence smallholder enterprises. The use of the integrated sequential mixed-method design enabled the interpretation of the farming perspective. The quant-qual approach in data collection directed the research into establishing details of significant variation in the farming system. This helped in guiding discussions towards the important variables during focused group discussions.

The dynamics of smallholder baby vegetable production in this study were traced through the established heterogeneity among the growers. The test for significance of the effect of the heterogeneity throughout the report guides the study on factors critical for diversified smallholder interventions. Therefore, interventions should not assume homogeneity within this group. Furthermore, the nexus of farm efficiencies, risks, and financial integration levels

in smallholder production studies are unique to the study and presents the need for building on smallholder farm enterprise management capacity in high-value crop growers.

This study contributes to the following:

- A. The smallholder farmers' benefit from the insight into their production system. They will know the inefficiencies and factors of recorded efficiencies as they seek to increase production benefits. The heterogeneity in the production system performance would advise on investment decisions through the envisaged return estimation for enterprises. The results of financial integration and risk predictability will enable farm management by enabling enterprise planning and risk minimization.
- B. The academic environment would draw from the results and the methodology of this project to guide future studies of smallholder horticulture production for high-value export markets. The gaps identified in this study present future research requirements.
- C. Policy recommendations were developed through a framework that guides interventions essential to foster smallholder farmer development in high-value production. The goal is to enable them to grow their products through proper farm enterprise and production management. Furthermore, recommendations advise on framework for a smallholder farm commodity system that targets high-value production.

1.6 Theoretical Framework of the study

The study defined the agricultural transformation approach as given in the assumptions of the Neoclassical Growth Theory, Schultz Theory of Agricultural Transformation, Farm Management, Financial Literacy Theory, and the Risk Management Theory. The underpinning is the production theory which regards as rational being who would allocate the farm resources only opportunities that will maximise farm returns.

Neoclassical Growth Theory

The Neoclassical Growth Theory was introduced by Solow and Swan in 1959, and it states that progressive economic growth is a product of a combination of labour, capital, and technology. Varied combination levels of these inputs result in short-run economic equilibrium while changes in technology advance economic development. Therefore, capital

accumulation and use in an economy are imperative for its growth rate (Solow, 1999). The theory is quantifiable through the equation below.

$$Y = f(K, AL) \dots\dots\dots\text{equation 1}$$

Where: A is technology, L is unskilled labour and K is capital. Such that, increasing the use of one input disproportionately to the others results in diminishing returns. Technology use, however, is boundless in its contribution to economic growth. Hence, there is the need for continued research into the development of innovations essential for maximising yields and improving resource use efficiency.

Schultz Theory of Agricultural Transformation

This is a modernisation theory using improved technology to transform traditional agriculture into highly productive farms (Schultz, 1966). Schultz argues that traditional agriculturalists are efficient in resource allocation such that reallocation of these would yield no benefits. Alluding to hierarchy, Schultz relates differences in production to the capacity of the producers and labourers in making profitable decisions. As a result, modern factors provide incentives for further investment into small farms. It considers farmers as seeking to maximise profits that they will adopt only profitable innovations. Amidst culture, Schultz regarded the persistence of farming information from generation to generation without alterations that without innovative technologies embedded with new incentives, the status quo remains. And even with the use of technologies, transformation reaches stagnation when there is no variation in innovation over time. This presents no strive for new production results. It guides that attention should be directed to the gains from innovations and movement of related risk on small farms. The inclusion of new knowledge for agricultural production injects inefficiencies in the allocation of factors. Therefore, the internal rate of return for production factors, as the cost of information, is the factor limiting agricultural transformation.

Farm Management Theory

An integration of two management theories best describes Farm Management Theory (McConnell, 1997). The Farm-systems Theory and the management by objective theory (Kast & Rosenzweig, 1974). Farm system theory drives the purposeful nature of the farm objective by regarding different facets of the operations as a unit that drives the production goal through a *means-end* approach. The management by objective theory encompasses the farm activities that seek to provide information for management decisions in the pursuit of maximised financial gains. Merging the production and profit goals of farm enterprises

enables regard to the allocation and interaction of resources, choices under uncertainty and insights into cause for management decisions made.

Financial Literacy Theory

The Financial Literacy Theory seeks to interpret human financial behaviour (Mwangi & Cheluget, 2016). Wise (2013) defined financial literacy as the composite of knowledge of concepts and products including the numeracy necessary for executing financial behaviour in managing financial flows; while Van Roij *et al.* (2011) add that financial behaviours include money management, risk management, debt and savings behaviours, asset accumulation and financial market participation. The credit and transacting costs influenced the relationship between an individual's financial literacy and enterprise performance in Ethiopia (Hieltjes *et al.*, 2013). Similarly, economic growth is influenced by access to and use of financial services (Jariwala & Dziegielewski, 2017) through encouraging household savings, proving needed capital for investments and enabling entrepreneurial activities. Therefore, linked to financial literacy, is financial inclusion which is concerned with providing adequate affordable and equitable financial services that enable safe and convenient transactions to marginalised members of society (Nwankwo & Nwankwo, 2014).

Risk Management Theory

Spikin (2013) defined risk management as the distribution of deviations from expected results and objectives due to events of uncertainty, be it exogenous or endogenous to the farm. The effect of risk factors is either negative or positive to the farm operations and it assumes risk as a driver of both losses and opportunities to business (Barnes, 2019). The possibility embedded for a threat or opportunity expresses the need for risk management in business. A reflection on farm production risks presents a theoretical gap in the decision-making process for any given choices to be made (Lewens, 2007). Risk estimation through the probability of occurrence and consequences, therefore, establishes a risk profile with a significance rating of each risk for prioritising interventions on vulnerable units. An Enterprise Risk management (ERM) is a structured approach that aligns strategy, process, people, technology, and knowledge with the production objective in risk management (Deloach, 2000; Bogodistov, 2017).

1.7 The Conceptual Framework of the Study

The Neoclassical Growth Theory assumes that the use and accumulation of capital advances development, such that an unequally aligned use of the inputs leads to diminishing returns.

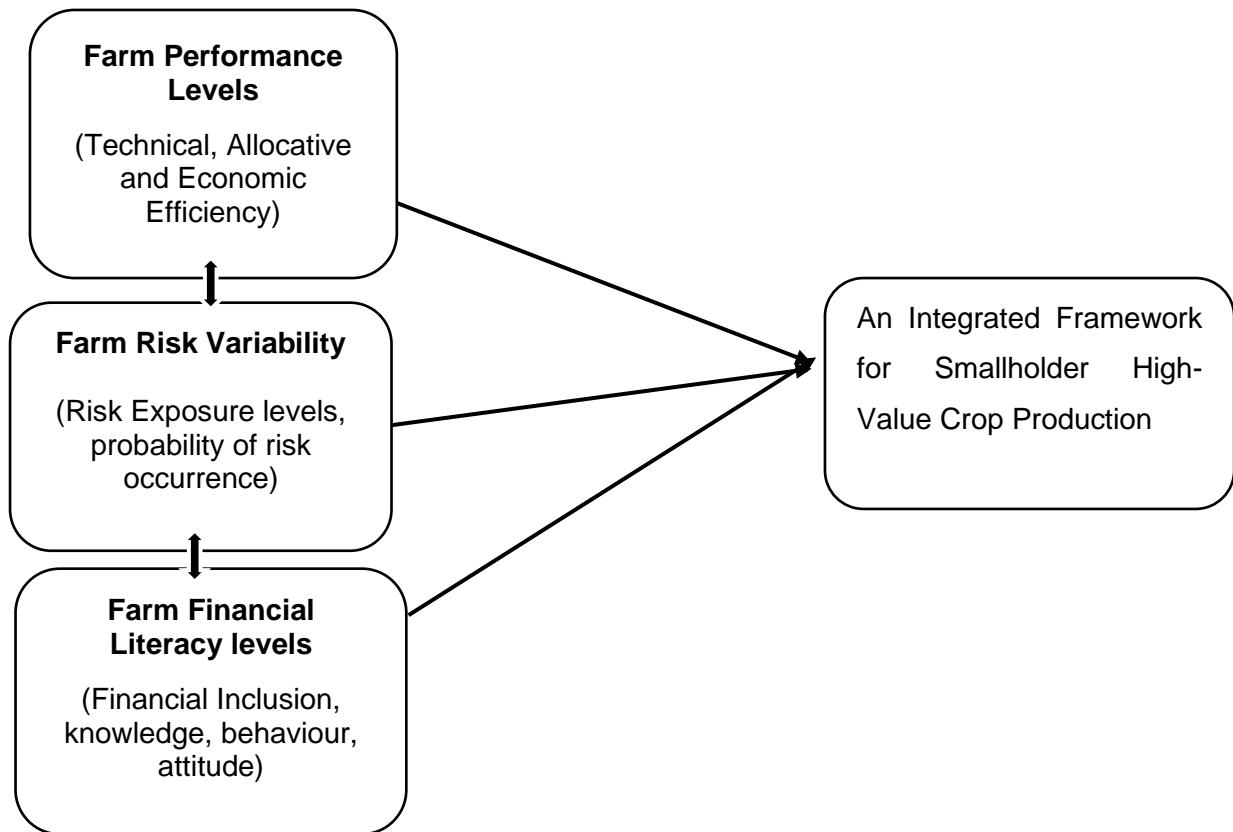


Figure 1. 2: Conceptual framework of the study. (source: own survey)

However, the continuous use of technology has exponential benefits through better yields. Information, communication, and technology (ICT) is paramount for socio-economic development in the initial stages of economic transformation as it promotes the welfare and economic positioning of the developing community (Muthinja & Chipeta, 2018). This is aligned with the principles of economic rural transformation steaming from improved integration of rural communities with the broader economic system and enhances the resilience of these communities as active economic players (IFAD, 2016). The goal is to enable productive activities that contribute to the economic benefits for improved livelihood in the value chain.

Similarly, Evenson *et al.* (1979) concurred that adopting new improved technological innovations in production has a multiplier effect on agricultural transformation. These technologies including climate pose risks to agriculture, notwithstanding the market environment they operate in. Farm risk management depends on the capacities embedded in farmer development and integration into the business environment. The business environment demands a consistent supply of quality products as well as the accessibility and use of capital towards investment and savings. This research conceptualized farm efficiencies as affected by the varied exposure to risk and financial integration levels of growers in the commercial sector (see figure 1.2).

Financial integration is defined as a product of financial inclusion and financial literacy levels of each farmer, whilst financial performance refers to the allocative efficiency levels observed in farm enterprises. The allocative efficiency captures the levels of input use in the enterprise through cost allocation and returns to farming operations.

The probability of risk exposure increases financial demands in enterprise management while financial access and use could be limited by proximity, literacy, and transaction costs. Financial access, on the other hand, refers to savings, investments, and credit mechanisms tailored to address the need of agricultural enterprises.

1.8 Operational Definitions of Key Terms and Concept

Value-chain Development describes a type of intervention that aims to address issues of the marginalized smallholder farmers through improved outcomes of the farm enterprises.

A baby vegetable is a fully ripe miniature vegetable cultivated for perfection as well as immature crops picked before fully grown, nutritious as regular-size vegetables, and most offer a more tender delicate taste and is highly perishable.

Smallholder farming refers to the practice of a mix of commercial and subsistence crop production or either, where the family provided the labour required, and the farm provides the principal source of income (Cousins, 2010)

Farm management is the process of making decisions about the allocation of scarce resources in agricultural production for meeting a specific management goal (kay *et al.*, 2008).

Farm system analysis is the study of how various agricultural activities interact to achieve the overall goals of the farm enterprise.

An inclusive value chain obtains supply from smallholder enterprises owned by marginalized farmers and enables them a better all-year-round livelihood.

Farm Performance refers to the outcomes of farm management decisions on the acquisition, allocation, and use of resources towards the livelihood goal.

Contract Farming Arrangement is a written or verbal agreement between farm produce buyers and smallholder farmers, which establishes conditions for the production and marketing of the desired product.

Dynamics are the forces at work, enabling or limiting smallholder enterprise outcomes.

Decision Making Units (DMUs) refers to the baby vegetable enterprises owners responsible for distributing resources and input quantities to be used in each season.

1.9 Outline of the Thesis

This thesis is made up of eight chapters. Chapters two presents a review of literature from theories, arguments, and policies as well as an empirical review of other research work on smallholder enterprise development and provide an insight into earlier arguments on the discourse. The smallholder situational analysis in high-value chains was achieved through assessment of their characteristics, efficiencies, constraints, and risks in their ventures.

The study design, materials, and methods adopted in the study are presented in Chapter Three, including details on analysis model specifications. A model specification for each method used is briefly discussed in this chapter, with more details to support discussions expended in each results chapter. Findings from the study are presented in Chapters Four through Seven. These are presented in a manuscript form with introduction, methodology, and results for each. Characterization of production systems is presented in Chapter Four and Five. Chapter Four includes the gross margins observed in production as well as the clustering of the growers. Chapter Five shows results of technical, allocative, and economic efficiencies of smallholder farmers' production, including the factors affecting the efficiencies. Chapter Six presents the financial inclusion and financial literacy levels of the growers and their impact on smallholder allocative efficiencies.

The smallholder farm enterprise risk and challenges are presented in chapter seven, which is split into two chapters. A quantitative assessment of the risks of venturing into the baby vegetable enterprise is presented in chapter 6a and the constraints of the smallholder enterprise development in chapter 6b. Chapter 6a is an article that has been accepted by the MPDI journal of agriculture. The synthesis of all results chapters is presented in chapter eight, where recommendations and the proposed framework for smallholder high-value crop development are outlined. Attached, also to this report are the UNIVEN project registration letter, ethical clearance, consent letter, research instruments as well as the list of growers.

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CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

This chapter presents an overview of the theories that have been used to anchor agricultural transformation as a driver for rural development. It discusses the underpinning theories of development aiming at building capacity for farm enterprises' intergration as key growers for for the high value chain rather than a perspective of linking farms into value chain. Additionally, details agricultural development and the key aspects and approaches of transformation in rural smallholder settings. The agricultural development policies in Eswatini are discussed later in this chapter.

2.2 Theories and Policies for Agricultural Development

Development refers to a desirable change to an affected group at a particular time, place, and culture (Singh, 2009). It targets improving the real income per capita, fair income distribution, access to resources, and the political and economic freedom of a community, nation, and or the world. A development framework refers to a guidelines in the public policy that drive the local governments, international organizations, and philanthropic organizations that influences the needed change in human lives (Dercon & Gollin, 2014). This, in other words, is an engagement process, an interactive phenomenon, and a goal-oriented strategy (Singh, 2009). Development that is sensitive to a target group's intergenerational equity needs is called sustainable development (Environment & Development, 1987). Therefore, rural development refers to the perpetual livelihood improvement of rural people, emphasizing the poor (Singh, 2009). However, agricultural development discourse underpins strategies aiming at smallholder farm-based initiatives and the attainment of food security.

2.2.1 Foundations of Development

In 1950, two distinct philosophies on development emerged: the Capitalists and the Marxist School. These have formed the foundation of debates on development in general. The Capitalist School established the Modernization theory, which presented the essence of modernity to society. Its basis was the transfer of the reasoning and technology of the Western World into the undeveloped countries to enable their development process through increased production (Singh, 2009). It emphasized industrialization and urbanization for agricultural growth. However, disregard to environmental impacts of industrialization and the varied economic effects of increased production was its shortfall. The stringent controls and limited human capital required rendered modernization ineffective in sustainable rural

improvement for undeveloped countries. International Keynesianism, however, better embraced the effects of rapid economic expansion and inherent environmental impacts.

The Marxist School sought to embrace inequalities, poverty, violence and military coups through the Dependency Theory (Valencia, 2017). Valencia argues that the continued struggle for economic class and conflicts of interests in global societies is an engine for social change and development. This interactive behavior between communities and interactions can be favorable or unfavorable. Therefore, the need for delinking relations with developed countries to avoid exploitation and direct efforts to self-development is favored (McKay, 2004). As the modernization theory, the dependency theory disregarded the effects of population growth, human capital development, lack of natural assets, and class struggle in explaining the development process. However, it provided the determinants of rural development as inter-sectoral linkages and exchanges of the target group as a basis for human development (Singh, 2009).

The Human Development Model advocates for human capital investment as a determinant in the economic and social development process (Schultz, 1964). This model recognized the heterogeneity and trainability of the labour force, productivity effects, and adaptability to technological transformation. Related to the abundance of unskilled human capital in developing countries is the Lewis Model of Development which advocates for improving labour's marginal productivity through industrialization and training (Lewis, 1954). Lewis argues that creating a capitalist surplus would induce more investment into industry expansion which will absorb the surplus labour, thereby increasing profits and national incomes (Singh, 2009). However, it neglects the heterogeneity in accessing credit for improved productivity levels in agriculture and its impact on labour surplus.

Cochrane (1969) formed the foundation of debates, and recommended investment into enabling agricultural growth. This is done through cash injections into agriculture modernization, supporting infrastructure and service development. However, Singh (2009) advises on controlled local population growth and the effects of '*bash wash*' and '*spread wash*' effects of interventions when rural development goal is to be achieved. Also, a proportionate investment into economic sectors to catalyze a holistic development goal is the basis of the Balanced Growth Theory (Pattanaik & Varghese, 2018). As part of the investment, Leibensteins' Critical Minimum Effort advocated for the investment in growth agents as drivers of empowerment through training, extension, and efficiency improvements in smallholder production.

Similarly, the Big Push Theory by Rosenstein-Rodan encouraged launching sustainable growth by providing minimum resources needed to enable the development process (Singh 2009). Rosenstein-Rodan argues that a minimum investment is necessary to help enable soaring above any economic obstacles that indivisibility can bring to the development process. Indivisibility is categorized into three, supply of social overhead capital, complementary demand, and the supply of financial capital. He regarded development as a series of discontinuous jumps, such that investment into each increase creates an atmosphere of growth and international trade. Similarly, smallholder farm development would require state investments into enabling each rise towards its integration into high-value markets.

Lastly, there is the Gandhian Model of Rural Development by Mahatma Gandhi of India (Jha & Jha, 2008). Contrary to the models discussed above, Gandhi considered moral and spiritual values as determinants of development rather than economic motives (Singh 1999). Similarly, John Stuart Mill argued further those non-economic factors have a crucial role in the development process by affording and molding the development design of institutions (Zouboulakis, 2001). Growth is reflected through embracing diversity in culture, beliefs, customs, and values.

Similarly, Talmaciu (2015) listed the following six economic and cultural characteristics that reflect trust; openness to external influence, perceptions on hard and labour intensiveness, desire to accumulate savings, social capital, social capacity, and trainability of subjects. Talmaciu (2015) further concluded that while developed European economies are characterized by trust, social capital, materialist index, and entrepreneurial culture, the developing countries use challenging work, desire to be rich, religious beliefs and are deep-rooted in traditions. Therefore, the population's attitudes, morale, and capacity are essential in the development process.

In addition, Meier & Baldwin (1957) affirms the roles of psychological and social requirements to the economic development process. As a result, McClelland & Hagen in Higgins (1966) established the Need-for-Achievement Motivation (N-Ach) Theory which advocates for prioritizing motive for the needed change and values in the target group as an initial step towards economic growth. The debate is in line with the pillars of the Social Dualism Theory by JH Boeke (Bonatti & Haiduk, 2014). Boeke noted the clashing of the imposed western social system with indigenous systems in enabling development (Singh

2009). The basis is the heterogeneity of macro and microeconomic societies that limit the use of a standard solution without adapting it to those concerned. Therefore, technological transfer and capital assistance are not sufficient conditions for development. Instead, an entrepreneurial mindset and an enabling environment through adapted institutions are equally important.

2.2.2 Unified Theory of Development for Rural Development

Unified Theory of Development for Rural Development relates to the diffusion model of agricultural innovation. It captures the methodological individualism that defines how an independent household or firm's decision to adopt new, improved technologies collectively transforms industry through shaping their lifestyles. It is an evolution of societal institutions from a singularity aspect across the multiple levels towards building convenient conditions for improved economic gain for the marginalized communities. This is achieved by enabling efficient resource allocation and use for maximizing production gains. These six levels depict the transition through which rural communities evolve as they sought to pave the way for gains through business. The rural marginalized society experiences limitations for business, mostly related to personal characteristics, inadequate training, and experience (Dufy, 2015). To enable these communities to develop, this theory, therefore, entails a transition along the levels; from the point where, economic gain seemed impossible and by adopting inclusion strategies, where these communities end up becoming significant economic actors. The transition of marginalized communities should be facilitated by a charismatic development leader such as the government, NGOs or any other development agency that designs and implement interventions to help such societies achieve sustainable economic benefits. The development interventions target enabling smallholder enterprise performance capacity through finance, knowledge, and production skills.

2.2.3 Theories for Transforming Traditional Agriculture

The theory of Change

The Theory of Change theory provides a guide to necessary interventions and actions towards a set goal that seeks to change the status quo. It involves four basic aspects; a common and collective understanding of the process by which the goal will be achieved; identify and acknowledge challenges and gaps in understanding the collective goal; construct of strategies for change drawn from the logical understanding of the series of change and engaging in theory and action learning (Adekunle & Fatumbi, 2014). The theory provides a roadmap for necessary action and strategies for each desired outcome and how nested results enable the reality for the envisaged goal in an integrated perspective.

However, in a linear model for agricultural transformation, the causes of reduced productivity levels are attributable to a poor economic environment with which producers operate. As a result, the inadequacy of land improved inputs, and policies exacerbate productivity levels. Therefore, research, extension and farm systems are the key elements of a solution-driven intervention in agricultural transformation. The linear model presumes that; 1) rigorous research providers need solutions to farm issues; 2) a good extension system will enable adoption of new technologies by farmers; 3) collaborative efforts of research and extension unit will enable accessibility of these technologies; 4) results of trials in research unit will be adaptable and acceptable to farmers, and 5) the market is always ready to receive improved products. The weakness thereof is the assumed adaptability of technology to all farm environments as well as the universal accessibility through collaboration extension and research. This assumption neglects the role of financing and trade promotion by suppliers. For a holistic shift towards the development goal, sector stakeholder collaboration towards innovative solutions is essential attribute of the innovation platform wherein multi-stakeholder cooperation targets identifying the problem and crafting the solution to the benefit of all sector stakeholders.

Observed is that the price for the innovation limits profits more than the yields produced by the innovation. Therefore, educating the farmer would enable rapid adoption, choosing the perfect technology and management of the risks. Literacy permits effective communication of knowledge at a lower cost than verbal translations. The regard to pricing captured the allocative efficiency of different combinations of inputs used in production. An alternative to allocative efficiency is the risk perspective of smallholder farmers, and on Survival Algorithms attributes to production under conditions of uncertainty. Agricultural production has risk elements anchored on climate variability. Farmers 'risk management options include leverage, sale of land, and off-farm income. Lipton concluded that profit maximization is embedded with considerable risk therefore farmers' degree of risk aversion can affect the profit goal. The level of education, household size, off-farm income opportunities and accessibility of extension services are factors determining risk aversion.

The principle therefore anchored on how farmers' probability of obtaining outcomes can be maximized. It presented the following the survival algorithms which captured their risk behavior: the 'safety principle' towards a predetermined disaster level; the 'lexicographic safety-first which ensures the probability of outcome losses is reduced; and the 'safety-fixed' this rule which sought to maximize the return that can be attained with a maximum acceptable risk by the farmers. To manage risk, farmers use a diversified mechanism, and Kahan (2008) categorized them into two: risk dampening and mitigation of risk exposure

results. Risk moderation practices include hedging, diversification, and the adoption of proven techniques for varied environmental conditions. Among risk-reducing techniques, the following practices are included: sequential risk reduction through fallow land for use when yield projections change; primitive social insurance where social ties bail growers of unfavorable consequences; farmers' insurance wherein they accumulate liquid assets to dispose of when the need arises, and lastly, lease uses the land value for credit and on the disaster the landowner share in the losses.

The Agricultural Treadmill

The Agricultural Treadmill presented by Cochrane in 1958 expressed diffusion as driven by anticipated economic pursuits of individuals seeking to maximize utility thereby resulting in optimized societal outcomes. It presents farmers as individual decision-makers, producing the same commodity, on a small scale that they cannot influence prices are price takers. Diffusion on innovation causes over-production and a drop in produce prices that without adaptation, other producers exit the market. The survivors on market changes absorb their resources and capture economies of scale.

In 1979, Evenson *et al.* presented the need for investment in deep research and extension. They used the results of adopting new improved technological innovations in maize production. Its multiplier effect on agricultural transformation presented a high internal rate of return for the investment made into research and extension. Also, Ruttan (1984) agreed with Evenson on the need for more research into new and improved ways of farming for overall sector development and farmer benefits. Furthermore, the void created by reducing public investment into facilitation and promotion of new and improved technologies by the Structural Adjustment programs (1990) has rendered smallholder development infrastructure unsupported. Furthermore, there has been no creation of the institutions necessary for the diffusion and treadmill theory to work in Africa as an enabling institutional environment for financing, marketing, environmental protection, and learning as it was in industrialized countries.

Business Model of Agronomy (BMA)

Business Model of Agronomy (BMA) is a fused agricultural development model formulated by merging the Diffusion Theory, the Treadmill as well as The Investment in Agricultural Research and Innovation Paradigm. It is embedded in the need for investment into science-based innovations that develop technologies and practices that will drive agricultural productivity and growth. Röling (2016) called it the BMA because it defines the role of

agricultural science and technology in sector transformation by directing the innovations, their delivery and use in agricultural development. It embraces the characterization of the users (farmers) either 'downstream' or 'upstream' for the adaptability and functionality of discoveries. Innovations have been promoted by the formation of farmer schemes to enable effective extension services on individual farm levels and scale productivity basis. Tilman *et al.* (2011), however, argued that using global food security as a criterion enables moderate and sustainable agricultural intensification than the use of yield per hectare basis.

Additionally, Röling (2016) noted that innovation development is a necessary condition for agricultural development, not a sufficient condition. This stems from the need for facilitating adoption and limiting innovation use for sustainability. Röling further recorded that the failure of the MBA is attributable to the research that has neglected analysis of actual smallholder farmer limitation in technological adoption and use. It disregarded the domains of innovation practice, local rules and regulations, cultural norms, and societal assets by which farmers secure their livelihood, leading to imposed technologies on smallholder entrepreneurs with less adaptive capacity.

Hounkonnou *et al.* (2012) described African institutions as dysfunctional individualism owing to the obligations of extended families, corruption, rent-seeking, lack of interest in understanding of smallholder farmers' issues and under-investment. Similarly, Röling (2016) concluded that farmers will grasp with alacrity the innovative development that is present and realistic to their affairs, be it gendered or resource constraint. The reflection of their actual farming conditions enables adoption.

On the expansion of the Alliance for Green Revolution in Africa (AGRA) programme, Clarks (2016) noted that the institutional review targeted capacity to use already established technologies than adapting them to be tailored to meet farmers' context, especially the farmers' limitation to use. As a result, the farmers depend on seasonal credit and subsidies to access agricultural innovations. These models fail to be sustainable beyond the life of the programme. Thus, Clark concludes that defining margins of successful intervention depends on; farm size and amount of surplus generated after loan repayment; and the ability of farmers to make sizeable gains in yields from the innovation. Rain-fed production is regarded as a gamble limited by the start of the rainfall season, where rain is not persistent and is inadequate in the cropping season. Interventions by independent external agents are fiscally unsustainable because: they are not embedded in government policy, lack transparent management and human capacity and are tax dependent (Röling, 2016).

Farm Management Theory

The objective of management is to attain the profit goal using the least cost methods and minimal resource requirements (Koontz, 1969). The success of management is thus borne in the efficiency of resources and effective attainment of enterprise goals (Kreitner, 1989). Effective farm management is, therefore, embedded with enabling industry policies, sufficient public infrastructure, industry-driven research and extension, strong industry alliances (McConnell, 1997). The farm manager is regarded as a decision model that is an entrepreneur, a risk manager, and a negotiator. The means-end approach of the farm system endorses both the systems objective and the interactions of the alternative strategies and constraints to achieving the goal. The farm system is non-deterministic, and variable given its stochastic nature, therefore, it is expressed through individual decisions given its uncertainty and complexity. The uncertainty and complexity of farms is anchored in the varied location, resources, human elements, and history such that decisions cannot be unanimous. Also, the varied execution of management functions, exercises planning and controls in farm management, an aspect that emphasises the exercise of education and power.

2.2.4 Agricultural Development and Rural Development

The use of agriculture as a vehicle for development stems from its ability to drive the needed change and it is regarded as a vehicle for economic growth (Johnston & Mellor, 1961). This is contrary to Singh (2009) who recorded that rural development should be of utmost importance in resource allocation to enable bridging the gap between the rural and urban sectors. However, agriculture influences developmental changes by enabling a shift from subsistence production into market-oriented production, the resource efficiency objective in optimizing gains as well as food self-reliance (Dercon & Gollin, 2014). It can engage the labour force, and the production of primary resources for industries renders agriculture a perfect driver of rural development. Small farms, dominating the rural areas, are characterized by limited power to influence the market, have conflicting roles and responsibilities towards driving the profit goal. These have few buyers for the product; bear the market losses to product quality as well as being located remotely from the markets. Refer to Figure 2.2 for a summary illustration of the smallholder agricultural transformation intended to impact rural development.

The importance of agriculture as an employer, food and a raw material supplier is crucial in the initial stages of economic growth (World Development, 2008). However, its universal

application across countries is varied by the differing economic and climatic conditions (Timmer, 1988). Micro agricultural development strategies target addressing market failures (Ray, 1998; Baordha & Udry, 1999), institutional failures (Schultz, 164, Pande & Udry, 2005) and behavioral failures (Duflo, 2006, Kahneman, 2003). However, the attainment of the smallholder farmers' development goals depends on how reflective the policies of the microeconomic group concerned (Tanyanyiwa, 2018).

Agricultural transformation is constituted in the diversity of farming systems through the movement towards cash crops and productive uses of seasonal labour to fully engage them all year round. Janvary & Sadoulet (2019) describe farm systems diversification to entail building value chains that are embedded with access to modern inputs and technology; as well as linked to markets with formal supply agreements. It can, therefore, be a product of backward and forward linkages with the final demand linkages. Swinnen (2018) also observed that value chains are embedded in transformation by linking farmers backwards through inputs and technology needed for production as well forward to the intermediaries, processors, and final consumers.

The transformation of smallholder farming and rural areas has been undermined by failures in government and marketing policies, which limit the adaptation and profitability of available innovations. These also restrict access to credit, savings, and insurance, which affect farm resilience through hampering liquidity of operations and marketable output. However, the basis of value chain development and inclusiveness is providing resources for a profitable production to the marginalized community (Bellemark & Lim, 2018). Profitable production is therefore realized through excelling beyond limitations imposed by the government and market failures.

According to USAID (2014), agricultural transformation is driven by inclusive growth where smallholder agricultural producers are integrated into competitive value chains (VC). There are two contrasting approaches for rural transformation and smallholder agriculture: the Push and Pull approaches (Janvary & Sadoulet, 2019). The Push approach targets to address the government and market failures so that farmers can reap the benefits of the transformation through the availability and use of new profitable innovations. Contrary, the Pull approach uses vertical and horizontal integrations with the VC as an incentive for transformation. Henceforth, enabling profitable inclusion and competitiveness of smallholder farmers in the VC.

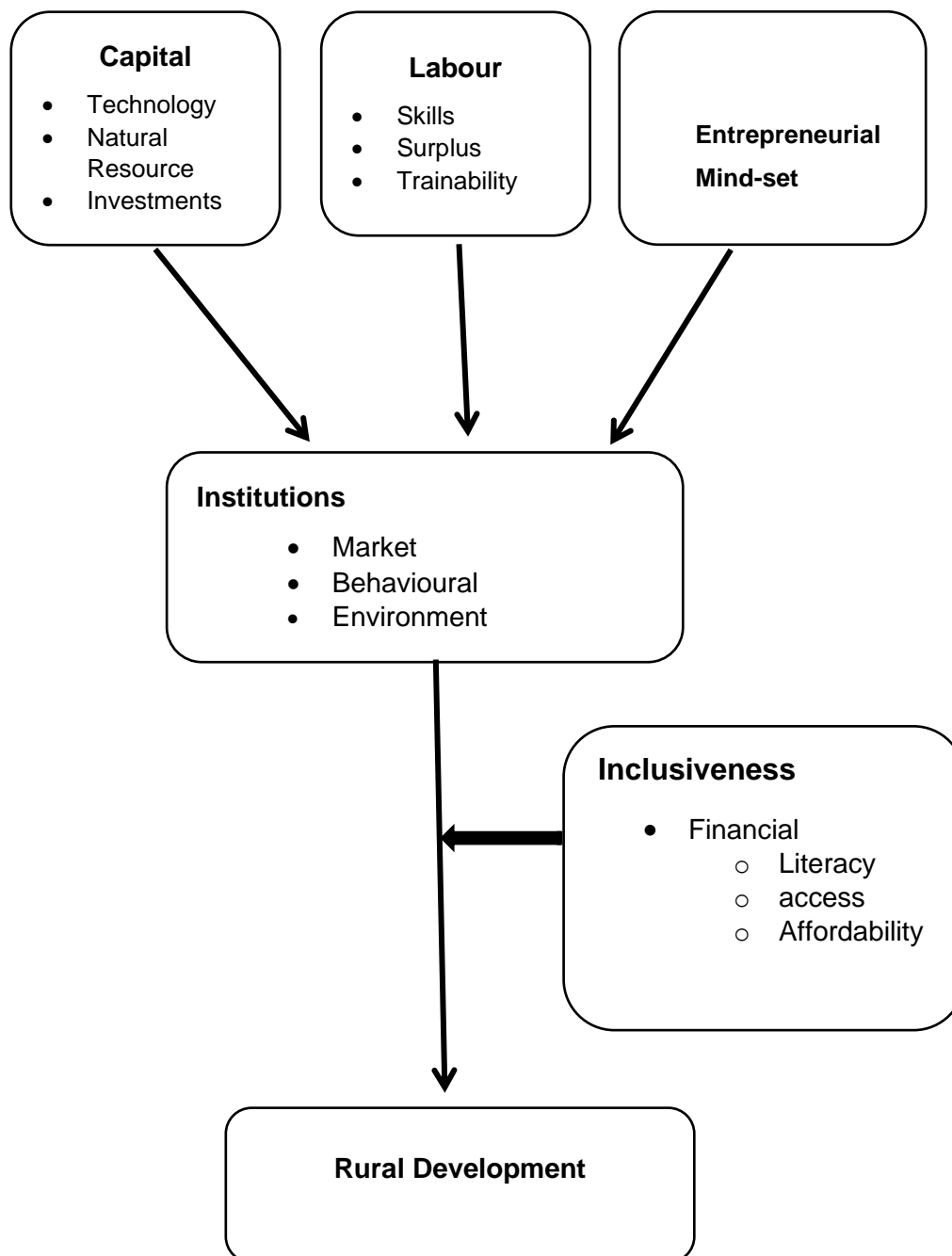


Figure 2. 1: Concept of Rural Development through Agricultural Transformation
(source: Authors)

Similarly, Swinnen (2018) reported that agricultural transformation can be attained through addressing the entry barriers into value chains as well as the constraints for capacity, skills, and coordination. These include building capacity among the producers through increased access to land, knowledge, skills as well as social capital development (Devaux *et al.*, 2016). In addition, the smallholder farming system diversification enables a reliable and consistent way of living for farm labour (Waha *et al.*, 2018). Systems diversification is, therefore, contained in the movement from a point of subsistence farming to a point of cash crop production coupled with all year round of labour to eliminate idleness within rural families. As a result, it proves to be a reliable and consistent way of living for farm labour (Waha *et al.*, 2018).

Profitable production for agricultural transformation is secured through quality produce. Produce certification is fundamental when value creation is sought to enable VC upgrading (Dequiedt, 2018). However, contract rigidity to produce quality standards poses a hindrance to smallholder farmer growth where alternative markets do not exist (Janvary & Sadoulet, 2019). Moreover, certification cost wears the producer margin from local prices which tend to perpetuate farmer side-selling against the supply contract. A typical integrated VC system is embedded in enabling individualism (Röling, 2016). It has conditions that enable institutions that support access to inputs, access to produce markets, and the feasible threshold for entry. Its criterion variables include input quantities per hectare per farmer; the proportion of harvest sold in markets, credit repayment capacity; and financing opportunities. To enable innovation use, a strong collaborative link with input suppliers and credit systems is essential, so is the access and use of credit systems.

2.3 Agricultural Development Framework using Agricultural Value Chains

Development resembles a causal and effective relationship with change (Singh, 2009). Whether, induced or autonomous, innovative transformations, socio-cultural, behavioral, and political spheres are realized in material possessions. The development agenda through agriculture is realized through; improvement in rural incomes, food price reduction in urban markets; capital mobilization for rural households; and competitive exports in world markets (Johston & Meller, 1961) while also contributing to GDP (Singh, 2009). The development of commodity markets has been used to fast-track growth in agriculture as well as smallholder

farmer integration into high-value markets. The VC is established as an integral part of developing market-oriented production.

The VC analysis is anchored on governance, and the identification of the chain actors who set the parameters to which other actors adhere (Humphrey and Schmitz, 2001). The analysis results in shaping market-directed interventions and VC upgrading strategies which enable smallholder farmer's gains, with a particular target to the marginalized rural growers in developing countries (van den Berg *et al.*, 2009; International Fund for Agricultural Development, 2010; Donovan *et al.*, 2015). On the other hand, value chain development (VCD) establishes the point of an intervention that targets to enable a pro-poor rural development strategy towards driving the integration of the marginalized groups in society (Donovan *et al.*, 2015, Stoian *et al.*, 2016; World Bank, 2007). It entails empowerment of communities through technology and access to credit and markets using institutional improvements that enable them to be more efficient and engage in high-value activities (de Ruijter de Wildt *et al.*, 2006; Mitchell *et al.*, 2009). The systemic analysis involves integrating three essential levels of the VC: (1) VC actors; (2) VC agents; and (3) VC enhancers. The aim is to unearth potential and bottlenecks within levels of the chain and the dynamics of their interactions.

Norell *et al.* (2016) studied how NGOs used inclusive VCD to enable sustainable food security among marginalized communities in developing countries. The results showed that VCD interventions targeted four development levers, namely, capacity building, improved access, improved productivity, and enhanced household influence by providing an enabling environment. Therefore, these interventions should target addressing household challenges in farm production performance, market interaction, and gender relations in farming through fostering profitability, equity, and empowerment of the marginalized society (Norell *et al.*, 2014).

In addition, Donovan *et al.* (2015) reviewed the eleven guidelines to VCD along six dimensions that included the review of interventions' objective. The results showed that these guidelines lacked conditions necessary for advocating for the development objectives and achievement of sustainability at different value chain levels. They guidelines ignored households' needs and circumstances by assuming they are homogeneous in the ability to participate in VCD and do not face trade-offs when using resources. By neglecting such dynamics, the variation in resource capacity undermined the inherent impact of the interventions. Therefore, this study sought to establish how smallholder farmer production

has contributed to the development plan. Considerations of the variation in location, organization and resource endowment can capture the variation to delivery on objectives.

The smallholder farming arrangements have been widely used as the engine of agricultural development. Yaro *et al.* (2017) investigated which agricultural commercialization model brought forth more employment and enhanced livelihood and local linkages while still reducing inequality in Ghana's access to land. Using the three commercialization models, namely: plantation, contract farming, and commercialization schemes; findings show that highly commercialized land relations had land security and high land prices than non-commercialized farms. Contract farming areas dominated traditional land systems where it enables farming families to diversify into wage labour while still producing their food crops (Yaro *et al.*, 2017). Hakizimana *et al.* (2017) found that commercial agriculture increased land consolidation by raising coffee farmers' class. However, land fragmentation was exacerbated by population pressure and land acquisition prevalence through inheritance among the horticulture out-growers.

In Asia, Sharma *et al.* (2012) observed that agricultural commercialization is driven by rapid urbanization, growth in modern agro-food markets, and economic growth. The Agro-food markets have shifted from stable grain to demanding high-value fresh produce from horticulture and dairy. The smallholder farm limitations to commercialization are inappropriate policies, access to technology, institutional barriers, poor infrastructure, and weak market linkages. This is a weakness born of the weakening in vertical integration, value chain coordination, collective systems, and credit access. Enabling smallholder farmer integration into emerging markets requires investment in post-harvest management, rural infrastructure, extension services, rural infrastructure, and research and development strategies (Sharma *et al.* 2012).

Aligned to commercialization is value chain empowerment, which refers to the level and scope of the smallholder farmers' involvement in the VC activities and its governance (Humphrey and Schmitz, 2002; Coles & Mitchel, 2011; Oduol *et al.*, 2017). It includes internalizing some activities in the production and in processing levels. Through VC upgrading, the chain actors expand their scope in the chain using the attributes of empowerment, and the upgrading strategies include product upgrading, process upgrading, functional upgrading and channel upgrading (Gereffi 1999; Humphrey and Schmitz, 2000; Kaplinsky and Morris 2001; Quisumbing *et al.*, 2014).

Product upgrading refers to the improvements made to enhance product quality and differentiation, while process upgrading refers to the efficiency improvements for the least cost method to be adopted for production. Functional upgrading, therefore, is concerned with the elevation of enterprises into higher value-adding processes on the product. The Channel upgrading strategy refers to the entry into a new market channel which is enabled by vertical or horizontal integration within chain actors for an improved profit and working environment (Coles & Mitchel, 2011). Empowerment in value chains, therefore, refers to the level of the farmers in the VC activities and its governance (Humphrey and Schmitz, 2002; Coles & Mitchel, 2011; Oduol *et al.*, 2017), that is, whether farmers have internalized some of these activities in production and processing including collaborating with other actors to address VC management issues which include defining produce grades and production standards.

The smallholder farmers in VC upgrade in four ways, namely, expand their roles as chain actors; engage in produce value-adding (vertical integration); exploration of possible formal chain partnerships; and owning the chain through direct liaison with the customers (Oduol *et al.*, 2017). Similarly, Vicol *et al.* (2018) concluded that interventions sort to upgrade farmers in the chain should enable them to capture more returns and growth from linkages with specialty markets. The assumptions are that; (1) relationship enable grower upgrade and facilitate value capture, and (2) accrued benefits will bear outcomes that will trickle down to the broader rural development objective (Selwyn, 2013). However, Larsen (2016) concluded that upgrading results often do not always favour smallholder farmer development. This is inherent to their marginalized nature that limit clear distinction of evidence of empowerment from political moves in rural settings (Bernstein, 2010; Pegler, 2015; Vicol *et al.*, 2018). Therefore, agricultural development upgrading strategy is often exacerbated exclusivity to benefit the local elites who were positioned to directly capture the benefits of development interventions (Vicol, 2018).

Stoian *et al.* (2012) recommended that VCD intended for marginalized communities should be born of an asset-based approach in its design, implementation, and assessment. The target should be to ensure that its interventions empower farming households to meet the minimum asset threshold to participate in the chain. This is contrary to the universal VCD assumption that households have enough resources to take part in the VC, households have no trade-offs in resource use, therefore, they could assume the highest risk for resilience in the chain (Donovan *et al.*, 2015). As a result, guidelines fail to impact smallholder farmer development by disregarding the incapacity to emphasize mutual learning for intervention tool design for the intended transformation. Limited regard to conditions essential for the

VCD and sustainability, therefore, limit the implications for implementation on the interventions. This study seeks to harness VCD with financial integration and risk management.

2.4 Smallholder Financial Integration and Agriculture Development

Schultz cited in Lothain (2006) reported that economic growth models have disregarded the heterogeneity in the rate of return of various innovations as an incentive for investments. Harberger (1988) related this tendency to the emphasis on technical changes than on the inherent cost reduction that innovations promise towards profit accumulation. Therefore, advocates for the use of the rate of return on investment and cost reduction triggers, and these include cheaper transaction costs and the use of technology with more financial than technical gains. This is an attribute of improved financial access to farmers through better interests and financial products.

Financial access is lowest in Africa when compared with the rest of the world (AFDB, 2013; Asongu & Odhiambo, 2018; Tchamyou, 2019). Access to finance enables household and business investment thereby contributing to improving equality in societies (Tchamyou *et al.*, 2019; Wale & Makina, 2017). It is, to a larger extent, driven by the level of information technology (IT) infrastructure in the economies which enables integration of the populations into the use of financial services. IT improves information symmetry and reduces risks in enterprises associated with rural settings for inclusive development (Tchamyou, 2019b). Similarly, Asongu & Azizi, (2018) pointed out that information, communication, and technology is paramount for socio-economic development in the initial stages of economic transformation as it promotes welfare and economic positioning of the developing countries (Muthinja & Chipeta, 2018). This is aligned with the principles of the neoclassical theoretical assumption of economic rural transformation which stems from improved integration of rural communities with the broader economic system and enhances the resilience of these communities as active economic players (IFAD, 2016). This is achieved through innovative initiatives that enable productive activities that contribute to economic benefits for improved livelihood.

Likewise, Habbiyaremye *et al.* (2019) advocated for novel inclusive approaches to be employed in driving the rural development agenda wherein the communities would be intensively engaged in mapping their development pathway, that is, embracing innovation as a model for expanding information frontiers for the tailored local specific solutions. It can also be achieved through raising resource productivity of low productive sectors through

specialized production and manufacturing (Lavopa & Szirmai, 2012). Amidst industrialization, innovation enables the solution-driven development to meet the immediate needs of rural societies (OECD, 2015). In agriculture, innovation for disease control, irrigation technologies, improved fertilizers, and improved varieties have enabled productivity in the sector. However, the impact of agricultural innovation is affected by the diffusion rates of these technologies within the intended users (Hall & Khan, 2003). These tend to be affected by resource endowment and knowledge.

Local capacity through social ties within communities, therefore, presents the absorptive capacity of innovation within the target group. These determine the financial and technical competencies, experiences, and management capacities towards embracing the development initiatives (Joseph, 2014; Swaans *et al.*, 2014). Considering collaborative efforts for agricultural transformation, the effects of power dynamics and agency contribute immensely to sustainability where the rural communities disintegrate from the processes (Papaioannou, 2014; Arocena *et al.*, 2018). Habiyaemye *et al.* (2019) listed the elements of integrated rural transformations as; cooperative learning, behavioral change and supporting infrastructure. However, successes in rural transformation are driven by inclusion, flexibility, empowerment ownership and effective communication in Australia.

2.5 The Relationship Between Financial Literacy and Efficiency

Financial literacy improved confidence in financial decision making and appropriate outcomes (Scheresberge, 2013). Hilgert & Horgath (2002) records that increased financial knowledge, attitude and experience influence financial management behaviour. Business planning enabled loan acquisition and control of variable costs (Mishra *et al.*, 2009; Ruben *et al.*, 2019; Huang *et al.*, 2015). A positive impact of FL on economic success of SME is record by Musie *et al.* (2015).

Evidence of the impact of financial literacy on efficiency in smallholder farming

Financial literacy (FL) influences the impact significance of financial resource availability required for enterprise growth (Owusu & Ismail, 2019; Hossain, 2020). This is by ability of farm-owner to identify and adopt profitable enterprises which could be financed with most profitable financing alternatives (Ying *et al.*, 2019; Resmi *et al.*, 2019; Lui *et al.*, 2020; Owusu-Agyei *et al.*, 2015). Owner level of FL is also positively associated with long-term small enterprise growth objective (Dieguez-Soto *et al.*, 2021) where owner financial awareness aids in managing profit and expenses (Ying *et al.*, 2019) while fostering risk management in the enterprise (Illmeyer *et al.*, 2017). Business sustainability and

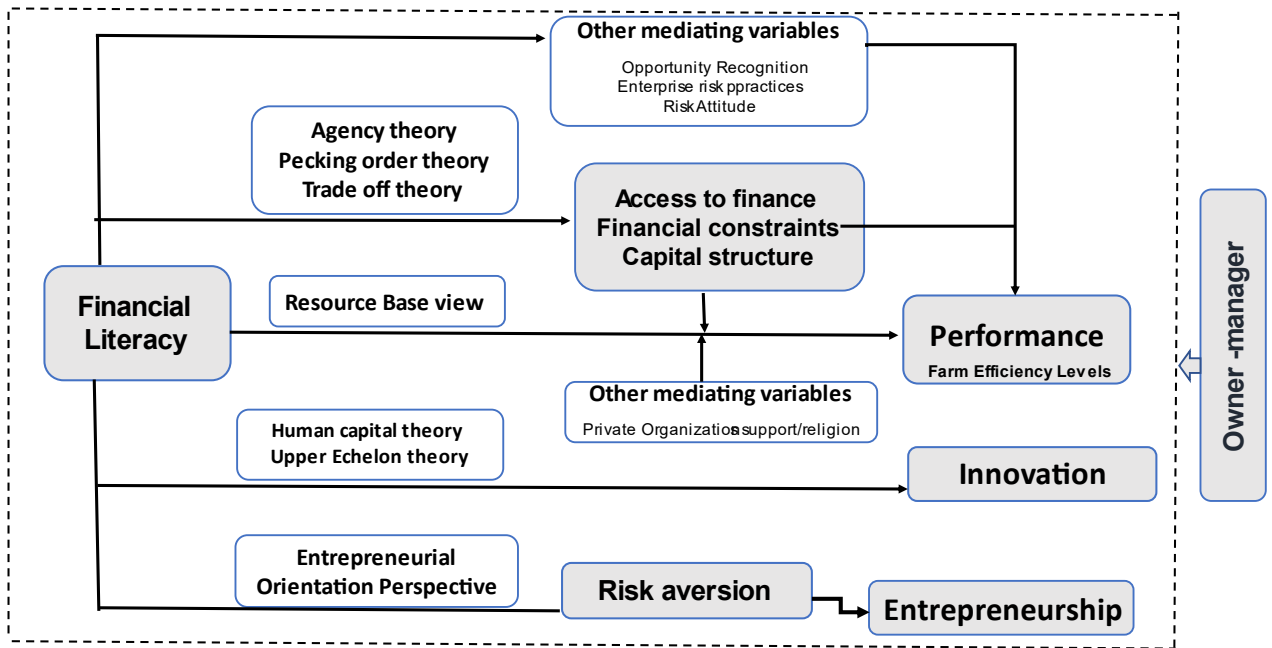
entrepreneurial development is interconnectedness with owner FL level, extension support and financing of the enterprise (Andriamahery & Qamruzzaman (2022). FL has also a positive impact on financial risk attitude and access to finance (Kuluthunga, 2019; Nohong *et al.*, 2019; Buchdadi *et al.*, 2020). However, finance access and financial risk attitude in SMEs mediates the effectiveness of the impact of FL on small farm's economic performance (Buchdadi *et al.* 2020).

Financial literacy (FL) is a direct medium for finance resource availability and finance risk attitude (Ye & Kulathunga, 2019), which is an essential trait for enterprise sustainability and growth. Financial literacy improves smallholder commercialization through enabling access to farm credit, amount of loan funds as well as global market integration (Mariyono, 2018; Muller *et al.*, 2015). Accordingly, Lui *et al.* (2020) concluded FL improves demand for innovation that enables management efficiency in farm enterprises. Therefore, improving financial literacy of small farm owners/managers can greatly impact the sustainability and growth of the agricultural enterprises.

2.5.1 Theoretical framework explaining the relationship between financial literacy and efficiency.

Figure 2.2 shows an integrative framework for financial literacy in SME, which better represents the application and drivers of FL in smallholder enterprise outcomes. High smallholder farmer financial literacy improves owner capacity to identify profitable opportunities, adopt risk management practices and improves risk tolerances essential for better business outcomes. Agency theory relates to the alignment of enterprise goals and decision-making capacity of the owner which with low FL could jeopardise the overall performance. The pecking order and trade-off theory points to low levels of FL also limits embracing the implications of external and internal finance as given by information asymmetry on decision making. These theories propel overcoming capital access and proper allocation in the enterprise for better returns. The optimization of benefits from both tangible and intangible farm resources is attributable to the resource-based view theory coupled with technical support and alliances that grow FL of owners also improve delivery on the profit goal.

The upper echelon theory drives the need for high FL of farm owner/managers to impact enterprise returns as emphasised by the human capital theory that building FL skills is essential for farm enterprise managers.



Integrative framework for Financial Literacy in SMEs by Molina -Garcia et al, 2022

Figure 2. 2 Intergrative Framework for Financial Literacy in SMEs

(Source: Molina-Garcia *et al.*, 2022)

FL skills for better efficiency drives the demand for cost-saving innovations which when combined with entrepreneurial orientation of the owner strategies permits unique flexibility that help in navigating other agricultural challenges for profitable outcomes.

Financial Literacy Training Programmes for Smallholder Farmers

Existing financial literacy training programmes in Eswatini

The National Financial Inclusion strategy 2017-2022 details financial literacy programmes that aim to build local capacity in Eswatini. These are business clinics, financial clinics, entrepreneurial analysis, and radio as well as talk shows (Government of Swaziland, 2017). These are driven as a collaborative between the Eswatini Enterprise Development Company, Centre for Financial Inclusion, Department of Cooperative Department, Eswatini Financial Services Authority, microfinance institutions and the private commercial and development. The smallholder farmers benefit from these programmes including tailored programs in the Ministry of Agriculture under the agricultural extension department and its alliances. Farmer training programs run as short-term training that seek to enable understanding, practice as well as demand financial services essential in fam management. Intended is sustainable growth through export growth, strengthening the business environment, entrepreneurial development, and import substitution. Thereby creating decent work and economic growth for all, sustainable goal 8. The National strategic Roadmap 2019-2022 recognizes the limited focus on strategies that enhance exports and economic development within the government (ESRM, 2018). It aims to focus on private sector growth to boot outcome orientation. The target sector for economic recovery is agriculture and agro-processing, among others. The objective is inclusive growth through the facilitation of export-driven growth and smallholder farm High-value market integration. Inclusive development upholds structural transformation through enabling productive capacities, productivity, financial inclusion, sustainable agriculture and reduced inequality.

Effectiveness of financial literacy training programmes for smallholder farmers

Improved access to financial services increases the profitability of climate smart agricultural investment and improved economic benefits of adoption of CSA practices (Ruben *et al.*, 2019; Nyasimi *et al.*, 2014). FL training translates the interconnectedness of credit, savings, and insurance towards adoption of business practices (Ruben *et al.*, 2019). High FL builds capacity for one to compare and use various financial services (Klapper & Lusardi, 2020), improves monetary benefits to the owner (Ma *et al.*, 2020) and permits better access and

inclusion into finance sector (Kodongo, 2018). Thereby influencing the demand for financial services, both form and informal (Adeturji & David-West, 2019; Gill & Bhathacharya, 2017). As given in Kim *et al.*, (2020), high FL for short micro loan for shortage remedies dropped as savings rate improved. Instead, a higher demand for complex financial services was increased with more FL levels in India and Indonesia (Khan *et al.*, 2021). Therefore, the contribution of FL training in smallholder farmers could build the demand and active use of financial services that allow for better business-to-business transaction for high efficiency of business.

Challenges facing financial literacy training programmes.

A moderate relation relationship between financial access and SME growth with high FL level (Bongomin *et al.*, 2017). Bylander & Phasy Res (2020) in Cambodia found that a 20-week long SELA training program by MFI has less effect on farmer FL levels. Results show limited capacity of farmers to navigate new financial products, financial institutions and understand financer responsibilities in the enterprises. However, MFI push for debt repayment using moral messages and provided a market for financial services. As Ruben *et al.* (2019) concluded successful upscaling of inclusive finance depends on a nexus of finance offer, technical assistance, and business support services. Accordingly, limited financial knowledge, financial practice, and financial attitude together could undermine the effectiveness of FL benefits in the enterprises.

Summary

Financial literacy is an essential driver of smallholder farm enterprise performance and sustainability. FL improves financial decision making, credit evaluation and use, repayment as well as guide savings and risk management is enterprises. FL level of owner/manager is key in the realization of smallholder farm commercialization through enabling standards adoptions, financial resource access, innovation and economic returns in the sector. This can be realised by improving financial education, financial practice and financial attitude of farm owner/managers.

2.6 Empirical Literature Review

2.6.1 Smallholder Farm Production Systems

A number of developments have been made by governments to enable smallholder farmers to produce for high markets, and one of which is the horticulture markets. Van den Broeck & Maertans (2016) reported that rural households are affected in two ways when producing for export markets: by participating in the pre-arranged produce supply contracts, through wage employment in the fields and the produce warehousing and processing plants; as a result, enabling rural employment and smallholder enterprise development opportunities.

Characterizing the smallholder farming households and classification of farming systems enables topologies that guide the design of interventions for agricultural developments. This can be through the value of income generated (Montiflor *et al.*, 2008; Donovan *et al.*, 2014), employment of labour (Orr *et al.*, 1999; Kuivanen *et al.*, 2016), and the diversification of the farm produce (Tittonell *et al.*, 2010; Ng'endo *et al.*, 2015; Pienaar & Traub, 2015) to classify farming systems. The results have shown that diversified farm was more stable and economically viable than specialized farms, while specialized cropping was dominating in Telangana State. Furthermore, Dembele *et al.* (2017) used household size and age to characterize crop farming families in Mali and five types were identified, namely, super large, large, medium, small, and young families.

Koutou *et al.* (2016) classified smallholder farmers using income from agricultural activities in Burkina Faso and they had less regard to the process, specification or complement of the incomes. Also, Singh *et al.* (2017) developed an economic evaluation of farming systems for agricultural production in Southern Rajasthan. Beyond the use of the gross farm costs, gross farm returns, net farm returns, the tool incorporated the gross income from integrated farming systems, the cost paid out for the integrated farming system and the cost of internally adjusted inputs. The results showed that a farming system is more feasible and sustainable when it has more resource use. Kealeboga *et al.* (2017) assessed the profitability of smallholder vegetable production in Botswana using enterprise budgets and observed that fertilizer, market availability and land size are the key factors of vegetable profitability.

Khan & Verma (2018) used gross returns, net returns, per day return, benefit-cost ratio, marginal benefit-cost ratio, and ANOVA to analyze profitability, productivity, and sustainability of integrating aromatic crops in the crop rotation of vegetables. The highest

monetary return was recorded with complementary cropping systems. However, the use of factor share analysis by Mariyono (2017) enabled determining the crops with the highest return on managerial skills, highest relative profit, and highest profit per crop cycle in vegetable production in Indonesia. The results of which might enable farmers to plan crop cycles and crop combinations per season.

2.6.2 Improving Farm Systems Performance

Mariyono (2017) used multiple regression analysis to establish determinants of the commercialization decision of smallholder farmers. The results showed that the decision is influenced by the following intervention mechanisms; improved links to markets, enabling proximity of markets and collection points, improving access to reliable information; the integration of farm services in mobile phones including payment services; farm, and information applications to enable the convenience of access through reduced transaction costs and time (Conway, 2016; FAO, 2017). There is a need to establish factors determining baby vegetable production enterprise performance, and to influence the commercialization decision by farming households.

Romeo & Wollni (2015) noted high rejection rates among broccoli growers, and it negatively influenced farmer production. Therefore, this indicates the importance of increasing transparency regarding the reasons for the rejections in the grading process. Saenger *et al.* (2016) proposed the implementation of third-party control mechanisms to enhance transparency in the grading process. High rejections provoke farmers' mistrust in downward actors in the VC (Romeo & Wollni, 2015). With no transparency in standards enforcement, the dismissal of the product cannot be justified by the farmer who bears the crop losses. Saenger *et al.* (2014) noted that opportunistic buyers underreport quality levels to farmers to reduce farmer prices, and this caused farmers to curb farm investment, which later negatively affected farm productivity.

Kariuki & Loy (2016) studied the factors in contract farming arrangements (CFAs) that enable their persistence in smallholder farmers in the horticulture VC in Kenya. They argue that, if decisions on quality control, governance, incentives, and distributional failure are made simultaneously, their understanding will improve the design of sustainable firm-farmer CFAs. Using multivariate probit model, results showed that the proportion of crop rejected to total harvest varied with farmers' knowledge, organizational capacity, and value for quality, but deepened in the mass markets. As an incentive, term price was correlated with the expected higher producer prices, greater extension, and the number of seasons at the same

buyer. Therefore, suggesting that incentives are based on value for quality, control, and trust between partners.

However, distribution failure because of unused products during harvest is negatively related to farm size, higher education, and extension, higher producer price, the number of producers in the village, and seasons with the same buyer. As a result, failure in distribution decreases depending on the scale of production, farmer's knowledge, level of control, the value in terms of quality, organizational capacity, and trust between partners, but is higher in the mass markets (Kariuki & Loy, 2016).

Rugege & Vermeulen (2017) studied on-farm and post-harvest investments for smallholder farming resilience in Rwanda using grant financing and the results showed an improvement in post-harvest handling. However, the grant administration process was not satisfactory to the beneficiaries. As farmers reported the lengthy bureaucratic access procedures. There was also the neglect of technical support towards financial skills and services accessible to farmers for use in the business.

Teklehaimanot *et al.* (2017) recommended equipping smallholder farmers as customer value creators, thereby transforming them into profit-oriented businesses so they can improve their livelihood performance, arguing that understanding how markets function and what customers' value, are the essentials for value creation and farm performance. Similarly, Annor (2017) studied the perceptions of Global GAP standards compliance and profitability in pineapple production in Ghana where the results showed that farmers perceived standards as a market incentive worth attaining, as it enabled significantly higher profits on the agreement. Recorded reasons for non-compliance included excessive costs of adherence to standards, uncompetitive farm-gate price, and low farm yield. Therefore, evidence proved that standard compliance favours pre-arranged production, high yield crops as is baby vegetable production.

Mariyono (2018) observed that returns were highest with combined vegetable production in Indonesia, and that eggplant and chili production have a high return on managerial return, highest relative profit, and highest profit per crop cycle. The synergies in management and use of resources are important in improving farm return and efficiency. In addition, Swinnen (2016) also noted that greater efficiency is realized with the adoption of standards in food production. Though it attracts additional costs, standards adoption helped reduce market

externalities, and improved information symmetry in the VC. As a result, it enables smallholder welfare gains. Also observed was that more variability exists in how standards impact industry development and their supply systems due to the varied resource endowment, production intensity and contract enforcement mechanisms. However, there is limited information on the goals for the combination of crops in baby vegetable production, wherein the target can be cash-flow management, a financing strategy, resource use efficiency, or risk management (Duffy *et al.*, 2012).

2.6.3 Resource Use Efficiency

The smallholder farm households engage in agriculture, relying mostly on their resources, with limited outside help. The support received is extended by family, friends, and other community members while little is from the formal sector (Riquet, 2013). Dinar *et al.* (2007) observed that determinants of smallholder farm efficiency can be classified into two: human capital (age, gender, educational level, and farming experience); and institutional features (access to credit and access to extension services).

Baruwa (2018) studied resource productivity of smallholder vegetable farms in Oyo State Nigeria by employing resource productivity, together with cost and return enterprise on farm-level data. The use of budgetary techniques and stochastic frontier analysis showed that seeds, fertilizer, and pesticides were significantly influencing resource productivity while more educated and older farmers were more efficient in resource use. Weldergiorgis *et al.* (2018) used a Tobit model for comparative frontier analysis for technical and economic efficiency for comparing irrigated and non-irrigated tomato production in Ethiopia. The results showed that under irrigation, farmers were technically inefficient in using labour and were not cost-effective in using land, labour, seed, and fertilizer than the non-irrigated farms. The identified factors of economic efficiency were education, experience, and the application of agro-chemicals.

Warsanga *et al.* (2017) evaluated the vertical and horizontal integration of the smallholder farm VCD using its effect on technical, economic, and allocative efficiency. The propensity score matching presented the economic efficiency (EE) was 64%, technical efficiency (TE) at 76%, and allocative efficiency (AE) was highest at 80%. As an approach to impact farm performance, improved smallholder farming sector links with the industry enabled farm efficiency levels. Also, the results indicate that more intervention is required for EE, wherein the farmers would have sufficient farm enterprise management skills.

Farming condition and industry regulation have an influence on TE. Cherry tomato efficiency farming recorded 52% TE, and it was significantly influenced by experience by farming experience, skilfulness of farmers, and alliances in commodity groups in China (Yang & Zhu, 2020). The tea growers recorded 90% TE where labour, fertiliser, and plant age were positive enabling factors (Priyanath *et al.*, 2018). In Switzerland, Austria, and Southern Germany organic farm efficiency analysis revealed that high diversification in organic farms and subsidies negatively influenced TE (Lakner *et al.*, 2018). Though high yields were recorded in Austria and Switzerland, diversification had an insignificant effect Southern Germany. TE and income were positively related in trained farmers on raspberry production in Chile (Jara-Rojas *et al.*, 2018). The results showed that adherence to quality and safety standards enabled financial flow into the enterprises. Contrary to Certification for quality and safety standards negatively influenced tea growers' technical efficiency in Sri Lanka (Priyanath *et al.*, 2018).

A review of research by Mukete *et al.* (2018) established that small scale cocoa producers' TE in Cameroon was limited by insufficient knowledge, lack of education, limited access to finance, and poor governance in the sector. Farmers lacked information on marketing, technical, business, processing, and modern farming methods. Growers lacked technologies to protect the crop from heat stress which was the main driver of damages in yields. Though the sector was privatised, smallholder cocoa growers had no understanding of its implications on their business and support thereof. Reflecting insufficient skills development to enable sector growth and smallholder farmer integration. Similarly, in the Indo State Nigeria, stochastic frontier analysis in cocoa production showed that growers were underutilising production inputs with an elasticity of 1.2 (Orisasona *et al.*, 2018). Lack of appropriate technical skills was found to be contributing to low productivity. Efficiency results help identify skills that limit productivity gains in agriculture (Bravo-Ureta & Pinheiro, 1997). Studies presented need for extension development to enable skilled growers and technologies for crop protection to grow maximum yields.

Baruwa (2018) studied resource productivity of smallholder vegetable farms in Oyo State Nigeria by employing resource productivity, cost and return enterprise on farm-level data. The use of budgetary techniques and stochastic frontier analysis (SFA) showed that seed, fertilizer, and pesticides were significantly influencing resource productivity while more educated and older farmers were more efficient in resource use. Weldergiorgis *et al.* (2018) used a Tobit model for comparative frontier analysis for technical and economic efficiency for comparing irrigated and non-irrigated tomato production in Ethiopia. The results showed that under irrigation, farmers were technically inefficient in using labour and were not cost-

effective in using land, labour, seed, and fertilizer than the non-irrigated farms. Identified factors influencing efficiency were education, experience, and the application of agrochemicals. Cost-saving methods for the use of land, labour, seed, and fertiliser would enable higher benefits from the same input levels.

Warsanga *et al.* (2017) evaluated the vertical and horizontal integration of the smallholder farm value chain development using its effect on technical, economic, and allocative efficiency. Results of the propensity score matching presented the EE was 64%, TE at 76%, and AE was highest at 80%. As an approach to impact farm performance, improved smallholder farming sector links with the industry enabled farm efficiency levels. Also, results indicate that more intervention is required for EE, wherein the farmers would have sufficient farm enterprise management skills.

Shrestha *et al.* (2016) assessed the EE of vegetable farms in Nepal using non-parametric methods. Results presented that the average farm size was 0.3ha with an output of 2.1tonnes per farm. All variable costs were significantly influencing vegetable yields and farms were slightly above constant returns to scale (1.049). The farms recorded 30% economic efficiency, 62% TE and 50% AE. EE was positively affected by seed type, training if farm manager, credit access, market access, external support index and women participation index. TE was positively impacted by the women participation index as well as the external support index. However, efficiency was negatively affected by the gender of the farm manager, wherein the women were more efficient than men in vegetable production. The external support index negatively affected EE while the seed types, manager training, credit and market access were positive and significant.

Akamin *et al.* (2017) studied the TE of root and tuber vegetables in Cameroon using the Stochastic Frontier Analysis. The average TE was 67%, with the highest at 94% and the lowest at 0%. TE with 80% of growers falling above 51% TE and 20% were below 50%TE. The gender (female) of the farmer and land size used for vegetable production positively influenced TE while the farmer's education level negatively influenced TE. On average, the farmers had secondary education. Land ownership, location and credit access were positive but not significant in influencing TE in Cameroon vegetable production.

Gwebu & Matthews (2018) compared the TE levels of commercial and smallholder tomato growers in the Nkomazi area in South Africa. Using the meta frontier analysis, results presented that the smallholder growers had an average technical efficiency of 74% while commercial growers had 89% TE. There were 52% smallholder growers and 43% of commercial growers who were technically efficient (TE = 1). Farmer education level, off-farm income and rental land positively influenced TE. However, the tomato staking, and use of

drip irrigation decreased the level of TE in tomato production. Renting of land and off-farm income commonly influenced both the commercial and smallholder growers, therefore, presenting differing management decisions in the production.

Dube *et al.* (2018) assessed the TE and profitability of smallholder potato production in Ethiopia using the parametric Cob-Douglas method. Results show that plot area, seed quantity, fertilizer quantity, and labour significantly influenced potato yields. Average TE was 80% with the minimum at 51% and maximum at 98%. There were 63% of farms within 90-100% TE while only 1% was below 50% TE. Older farmers, owned land, higher education, an alternative source of income, frequent extension contact, and having large plots increased TE while a larger household size decreased TE. In Guinea, potato yields were significantly influenced by plot size, improved seeds, and quantity of fertilizer used (Tolno *et al.* (2016). However, results were negatively affected by production losses.

Xu *et al.* (2018) used SFA on panel data for smallholder vegetable production in China. Results presented all growers to be above 99% TE; the mean was 99.8, and the highest was 99.81% in 2004. Thirteen per cent of the provinces have TE means above 85%, while only two have TE means less than 75%. Household income and the risk of disaster for the area were negatively influencing TE. Fertilizer labour used also decreased TE presenting variation in overuse. TE was improved with an increase in urbanization, rural educational standards, irrigation rate and land costs. Osmani *et al.* (2017) recorded a national average 91% TE rate with the highest at 95% and lowest 83% in Albania. The amount of capital used irrigation, labour, and improved commercial efficiency while farm size and fertilizer decrease it.

Kansime & Sneyers (2018) assessed the effect of farm diversity on farm topology and SFA's technical efficiency in Eastern Africa. Results show that level of farm income and land size used varied significantly across farms presenting three categories. These were specialized farms, diversified farms, and off-farms farms. Labour and fertilizer quantities had a positive effect on yields in diversified and specialized farms. However, seed quantities were negatively affecting technical efficiency and were attributable to seed quality in Uganda. The extension services and commercialization index had a positive effect on TE in specialized farms. The land size was positively affecting TE across all farm types. In Eswatini, organic vegetable production was significantly influenced by land size, household size, farmer level of education and land ownership. Resource use efficiency was improved with farmer age, labour, organic manure, seed, and land preparation. However, the rate of irrigation is negative to organic vegetable production. The production scale efficiency was 1.07, indicating increasing returns to the scale of the present and an increase would attract 7%

profit. Similarly, education level, organic farming system and soil improvements positively affected the technical efficiency of organic growers in Thailand.

In Pakistan, Muhammed *et al.* (2017) used a Cobb-Douglas production function for yield estimation and an Ordinary Least Squares to model the factors affecting tomato production. Machinery, irrigation water, use of agrochemicals, seed, and fertilizer, were underutilized in the production process. However, overuse of farmyard manure and labour was recorded and negatively affected production.

In India, Ataputta & Rupasena (2016) smallholder ginger yields were increased using seeds, fertilizer, manure, seeds, and agrochemicals. AE showed that fertilizer and manure were underutilized in small farms while large farms overused fertilizer and underutilized manure. All farms underutilized seed and agrochemicals in ginger production. Red onion profitability was increased with improvements in seed and fertilizer rates. The cost-benefit ratio was 1:4 showing the enterprise generated 40% of every dollar invested. However, farms could benefit from an 11% improvement in technical efficiency of the present input quantities employed in the production.

2.6 Value Chain Development Coordination

Orr *et al.* (2018) noted that smallholder farmers have a high risk of failure as economic players in high-value chains because they have limited access to information, productive assets, and less capacity to adjust to shocks (Orr *et al.*, 2018). They argue that VC analysis should regard the complexity of VC and the actors' risk management capacity. A risk management system is informed by identified and predictability of risks associated with each value chain. Lipton's theory on risk management alludes to risk identification and prediction to establish strategies for enabling positive outcomes (Lindahl, 1987). Three principles guide the establishment of risk management strategies, namely: safe-principle, lexicographic, and safety-fixed principles. The approaches towards a predetermined risk probability apply the safety principle; those seeking to lower the likelihood of outcome losses apply the lexicographic code while strategizing to maximize gains from a predetermined level of risk using the safety-fixed principle. However, risk management is a continuous process, as illustrated in Figure 2.3. Therefore, the smallholder farmers' capacity to make informed decisions begins with enlightenment on risk exposure and predictability.

The transition from subsistence farming has inherent risk exposure, which the farmer needs to embrace for successful commercialization. Hardaker *et al.* (2004) identified five transitional risks associated with commercialization: production risks, market risks,

institutional risks, financial risks, and business risks. Information on enterprise risks, therefore, enables a farmer to choose an enterprise concerning risk averse as well as downside risk assumptions. Risk-averse people forgo risky opportunities while downside risk enables production within a safety principle because of predetermined risk information.

The smallholder farm transformation success in Thailand is driven by firm commitments to the smallholder farm development strategy through investment into adaptive research on risks of commodity markets and increased financial access by farmers (Byerlee *et al.*, 2014).

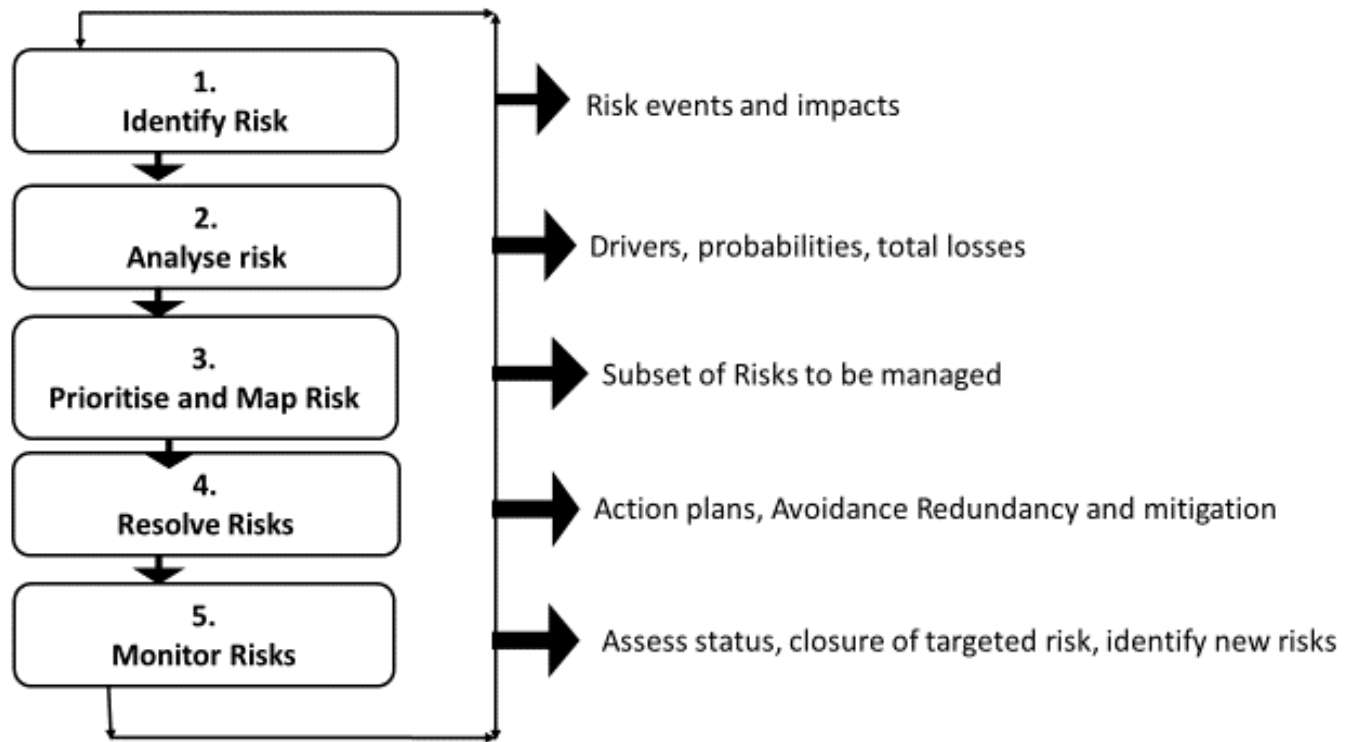


Figure 2. 3: Risk Management Process by Smith and Merritt (2002)

Successes were further catalysed by redefining smallholder farm production scale to 8ha or less, a dependency of volatile market commodities that had huge risks, over investments at a short interval, and extended land expansion through deforestation. Farmers adopt contract farming based on their risk perception and present experience on market failure (Arumugam *et al.*, 2010; Flakerud & Klenow, 1999). The smallholder farmers, however, engage in contracts mainly for their potential to reduce market risks and simplify production for effective management (Arumugam *et al.*, 2010). As a tool for smallholder farmer inclusion, a well-specified contract would include extension and assistance programmes towards reducing

Hailu *et al.* (2017) determined the factors constraining the production of potatoes in Ethiopia using the Multiple Linear Regression and Index Ranking. The results showed that productivity levels, natural hazards, seed rate and cost of improved seeds significantly affect productions, while predominant constraints among farmers were disease, storage, and low market prices. In Botswana, the smallholder vegetable profitability was constrained by; lack of water, pesticides, market, and low market prices hence an information gap was noted on interventions essential to enable farmers to strive under these conditions (Kealeboga *et al.*, 2017). As Sithole *et al.* (2014) noted Swazi Smallholder Irrigation Schemes experience low market prices.

Monaren (2013) studied the baby vegetable industry in South Africa and noted that they are produced for both domestic and export markets, where producers added value to the crop at farm-gates. However, the enterprise challenges included excessive cost of production; marketing; capital; climate change and diseases affecting the produce; instability of the export market as well as complying with market standards. Furthermore, farmers mixed data on baby vegetable production with that of conventional vegetables making it difficult to make direct assessments of this niche market.

Nwafor & Westhuizen (2020) classified the smallholder farmer constraints into five categories, namely, resources, technological, financial, product and structural. The resources constraint relates to land size, land quality, water access, education, health, and low income; technological constraints, on the other hand, include land productivity, TE, skills, training, and storage capacity. Deficits in cash flow, credit, and insurance formed financial constraints, and the volume of harvest, produce quality, seasonality of production and lack of associativity are product-related constraints. Lastly, structural constraints include infrastructure, weather, geography, laws, and regulations as well as land tenure policies. Combined, all these constraints limit small farms' access to markets. Giller (2013) recommended the adoption of farming systems analysis in understanding integrated farming

decisions and the effect they have on the participation of farmers in value chains. Also, it enables a better understanding of the farmer's production decisions (Leonardo *et al.*, 2015). Therefore, the study on baby vegetables will establish development interventions through combining aspects of farm efficiencies, risks management and financial integration as drivers for improved farm performance in the rural areas of Eswatini.

A gap exists in linking producer organizations through contractual arrangements to the quality supplied. Linking farmers through contractual arguments has a bearing on their capacity to deliver on supplier requirements, herein referring to the payment services that they can afford to ensure low cost and speedy transactions (Ouma *et al.*, 2017). Furthermore, linked to the payments is how swiftly the market payments can be received to meet supplier demands. This is a crucial element to agricultural enterprise performance.

Ayele *et al.* (2012) noted that VC upgrading helps foster links and interactions between multiple actors as it enables knowledge sharing, capacity building, shared learning, and continuous problem solving, thus, enabling smallholder farmers to participate in high-value markets. Ros-Tonen *et al.* (2015) used agricultural innovation systems to study VC collaborations, however, Kilelu *et al.* (2017) used the VC upgrading and innovations systems to explore how multi-stakeholder processes enable smallholder farmer inclusions in Tanzania.

2.7 Assessing Financial Inclusion (FI) in of Smallholder Farmers

Numerous definitions have been brought forth in literature for financial inclusion (FI) and most recently is Koner (2017), who defined it as the delivery of financial services to all sections and segments of society. Park & Mercado (2015) noted that factors limiting the level of FI include the quality of institutions, availability of information, good governance, and the financial regulatory environment. Institutions include the network one is embedded and its contribution to awareness of services available, including their benefits.

Karlan *et al.* (2010) argued that the uptake rates and use of financial mechanisms signal the interest of a given group, therefore, informing the design of the products best fitting them. The results showed that in Mexico, the low take-up rates for credit, savings, and insurance products were an indication of existing settings and products that do not serve marginalized households, and the level of creditworthiness of the borrowers' given conditions laid down by the formal sector. The extent of user access and use of financial services by baby vegetable

farmers in Eswatini is of interest to this study as an indication of inclusive financial service development.

Embedded in the FI objective is enhancing financial literacy which Hsiao & Tsai (2017) defined as the finance-related activities in everyday life. Measuring financial literacy of participants in derivatives markets in Taiwan, Hsiao & Tsai (2017) used nine (9) indicators for financial literacy, namely, cash management, savings, credit management, pension management, investment management, financial information, insurance and risk prevention, financial planning, and insurance management. The results of the study showed significant benefits of literacy as it reduced barriers of market entry while participation in derivatives markets was significantly affected by household wealth, gender, residential location, and the number of sources of income. An understanding of financial literacy in the baby vegetable sector will enable an understanding of how the farmers decide to grow for and invest in the export market.

Full access to financial services implies an absence of price and non-price barriers in the use of financial services; it is difficult to define and measure because access has many dimensions. Fan & Zhang (2017) developed a model to assess the relationship between FI and entrepreneurial formation. They argued that FI could mitigate credit constraints on entrepreneurial activities by reducing information asymmetry in financial transactions, therefore having a more significant effect in industries with lower entry barriers. Using data from 31 provinces and 19 industries across China, the data confirmed that the development of financial inclusion has a positive effect on entrepreneurs' formation, and it comes with financial education, whether civic or professional. Gale & Levine (2010) noted that financial education approaches are employer-based, school-based, credit counselling, and community-based. Therefore, financial education can be described as the knowledge, skill, and enlightenment that elaborates and gives insight into financial concepts and improves one's financial literacy level (Zaimah *et al.*, 2013). Agricultural entrepreneurs in the export markets too can benefit from FI; however, little is known on how FI through the whole basket of services affects the smallholder farming sector.

Aminu & Adjei (2015) studied microfinance impact on agricultural production in Ghana using a cross-sectional survey and focused group discussion (FGD). The results showed that the micro-lending ceiling amount was set for individual and group lending, and it varied by type of provider. The growers used credit to expand operations, buy new, improved varieties for to increase output and their incomes. The short-term group lending had off taken because of

risk mitigation. Default rates were almost zero after providers increased the ceiling for group lending. Microcredit amounted to 35% of the variation in production levels, and it impacted production levels in fish, rice, and yam. The need for collateral and farmers' failure capacity to fulfil access requirements were listed as challenges to agricultural loan access.

Geol & Sharma (2017) studied FI in India. They described FI as a system through which developing countries can attain inclusive growth by connecting the rural populations' contribution to the mainstream of the country's economic growth. The high FI helps reduce farmers' indebtedness, promoted grassroots innovations and entrepreneurship, and improves the people's standard of living. Indicators of FI in the banking sector include bank penetration, availability of banking services, and banking systems usage by marginalized populations (Mwangi, 2019).

Allen *et al.* (2016) defined FI as formal accounts by the rural, poor, female, and young individuals in society using three indicators; ownership of funds, use of accounts to save, and accounts to withdraw in the last three months. The results show that greater FI was associated with lower account costs, greater proximity, financial mediators, stronger legal rights, and political stability. Respondent's barriers to account ownership were lack of money, while success was attributable to the low cost of accounts and greater penetration by service providers. However, the effectiveness of inclusion policies was limited by poor regard to the targeted marginalized groups' context. Also, policies were less effective in encouraging account use by women and youth.

Boukhatem (2016) studied financial development in 67 low-and-middle-income countries. The results showed that an increase in money supply through credit increased the well-being of the poor. The growth of financial transactions leads to asset accumulation and the smooth consumption of goods and services. However, financial instability led to high poverty and fewer benefits from financial development.

Kim *et al.* (2017) used dynamic estimation and panel data to study FI and economic growth in Islamic (IOC) countries. Variables used for its estimation were account ownership, bank penetration rates, savings level, level of credit use, and insurance use. Results show that FI has a significant positive effect on economic growth as its level was a critical factor for economic growth in these countries, these was variation was recorded among countries. There was variation in Islamic religion levels, illiteracy rates, interest rates, gender inequality, interest rates, income levels, and the FI policies.

Dermirguic-Kunt *et al.* (2018) found that not having bank accounts in developing countries was affordability, the relevance of use and document requirements. There were 63% of

voluntary respondents that reported insufficiency of their incomes to use bank accounts. Another, 25% depended on one account owned by a household member to make their transactions. Insufficient funds for financial services reflected that the group depended on daily earnings which could be redeemed within banking hours. Also, this group rarely used credit cards as most shops do not use credit cards payments, hence the regard insufficiency of funds for such services accessible through bank accounts. Twenty-six percent had no bank accounts from the involuntary group because financial services were expensive while 19% reported a lack of necessary documentation.

Yesuf Awel *et al.* (2017) studied FI and gender disparity in risk appetite and MSE performance in Ethiopia. They used a moment-based approach to estimate risk preference by gender and a regression model for risk attitude correlations. The results indicated that these entrepreneurs were risk-averse, but females were more risk-averse than males. The entrepreneur risk attitude is significantly correlated with age, experience, marital status, education level, wealth, industry, business type, and financial literacy.

A study on the impact of agricultural credit on farm income under savannah in Ghana was conducted by Abdalla *et al.* (2018). The aim was to establish factors contributing to farm income and the impact of credit on farm income in each zone using endogenous switching regression and propensity score matching for robustness results. The findings showed a significant mean difference between household characteristics and credit access. Farm size, labour, gender, age, literacy, wealth, and group membership were significant determinants of credit access and income in both zones. However, selection bias was reported in the distribution of household covariates. Productive resources, information, and household characteristics enabled access to credit and high farm income, while access to credit led to significant farm income gains.

Rouse & Verheef (2017) studied mobile banking trends in banking development in Sub-Saharan Africa (SSA). The results showed that by 2015, the region had a 77% penetration in mobile connections and 41% of unique subscribers. Kenya had exceptional mobile money (MM) leadership in Africa with 60% of its GDP moving through MM and 70% of households using MM *Mpesa account*. The mobile technology was significantly reducing the costs of sending money over long distances provided certainty of process and minimizing the risk of theft which promoted use. Mobile saving loans (*M-Shuan*) facility had nine million customers and depositors of over a 1.6billion within two years of its launch. The loans were cheaper to administrate and easier to scale up than micro-lending operations. *M-Kesho* was linked to formal bank accounts and uses the *M-Pesa* platform and network agents to offer more banking services to customers like interest-bearing accounts, loans, and insurance.

However, for successful MM account operations, there is a need for a revised nature of the regulatory environment for market openness to allow interoperate links and expand the mobile network.

Rentala *et al.* (2016) sought to determine FL through access and usage of banking services over ten years in South Asia where they used, bank branches, ATM, and mobile money transactions as variables for FL. The results showed that 14% had bank accounts but this had no link to other financial services like savings, credit, and insurance. Identified factors influencing FI were access to a bank account, geographic penetration of ATMs, demographic penetration of bank branches and MM accounts. These also impacted the access and use of banking services. There was a significant and positive relationship between women empowerment and microfinance products that they used to save for rent, child education, newborn accounts, and daily household requirements. However, inadequate income is limited to women's FL.

A study on agricultural credit and economic growth in rural areas was conducted by Hartaska *et al.* (2017). The aim was to establish the link between finance and economic growth from the 1991 - 2010 period; fixed effects were used to estimate the causal effects of credit supply on agricultural GDP growth. Grohmann *et al.* (2018) asked this question at country level: Does financial literacy improve financial inclusion? The results showed a positive and significant measure of financial inclusion and they concluded that financial literacy is essential even at the macro level.

2.7.1 Smallholder Farmer Use of Financial Services

Financing and financial services have a vital role in enabling the success of agricultural VCs. In Rwanda, Rugege & Vermeulen (2017) studied the contribution of investments into on-farm and post-harvest resilience in climate change in smallholder farmers in these VCs using funded participatory trials. Results of the small grant injected showed significant improvements in the post-harvest capabilities of the farmer organizations, however, shortcomings were reported in the grant award process. Farmers were also not satisfied with; the services received on business plan preparation; the high bank interest charged on the grant and the lengthy bureaucratic access procedure for the assistance. This research is in part expanding the role of financial services to the smallholder farm performance. It sought smallholder farmers' perspective on the FI that was embedded in the programme, therefore recognizing their inherent contribution to their success in the VC.

Peprah (2010) studied the access to vegetable farmers' credit and TE in the Mfantseman District in Ghana using Stochastic Frontier Model. He included access to credit as a policy variable, a farm input from which other production inputs come, such as fertilizer, hired labour and acquired capital. Access to credit was highly correlated with the TE of the farmers. The results showed the need for improved access to credit if farm performance is desired. "If there is no credit leakage (100% use of credit for farming purposes), farmers become efficient," stated Peprah (2010, pp 19). This emphasizes the need for financial literacy for proper financial decisions at the farm level.

Sulemana & Appaih (2015), while studying the impact of agricultural production in PRU Ghana, used a cross-sector survey and FDGs, and observed that group lending had almost zero default rates. Results also show that microcredit was used to expand farming operations, increase output, and income levels. It accounted for more than 35% of the variation in enterprise production levels. The impact on production was positive. However, reported challenges include farmers' inability to meet loan access requirements such as collateral, prior savings with the institution, and membership to a group, which most farmers had not considered before. Noted was that farmers were enlightened and started practicing the planning skills inherent of the program. The farmers' need for empowerment on financial services and management skills was noted by the African Bank (2014) as being vital for their transition from subsistence to commercial producers and so is the building of the saving culture to boost creditworthiness and reduce dependency on loans.

Also, Walandari *et al.* (2017) used a Data Enveloping Analysis to analyze the relationship between TE and finance access in horticulture enterprises. The results showed that credit banks had a positive effect on TE, and at the same time, flexible credit from microfinance and input credit schemes has negative effects together with subsidized credit from commercial banks and in-kind credit from input suppliers. Moreover, finance from friends and family did not affect the TE. This result informs the design of tools and mechanisms of credit interventions seeking to improve the TE, whose effectiveness of financing tools for baby vegetable farming is unknown in Eswatini.

Dinar *et al.* (2007) observed that farm performance is influenced by access to credit. Farmers that used a given loan amount to purchase better quality technology such as fertilizer, pesticides, and herbicides are likely to improve their farm performance (Sossou, *et al.* 2014). However, Oboh & Ekpebu (2011) observed that farmers who diverted the farm loan to other activities different from the initial purpose of the loan acquisition were likely to fail in producing optimally, thus, failing to repay loans. Girabi & Mwakaje (2013) mentioned

that the lack of information, inadequate credit supply, high interests, and defaulting as factors proven to hinder smallholder farmers' access to credit. These results emphasize the need for financial literacy in smallholder farming inclusion initiatives; however, little is known about the baby vegetable growers in Eswatini.

In South Africa, Tibesigwa *et al.* (2016) observed that the use of financial access instruments was limited among smallholder farms managed purely for household security than those used for business while the poor and marginalized farms were more exposed and vulnerable, and they adopted conservative production. However, warmer climates positively affected a commercial farm's net revenues, an aspect to be considered in the design of financial mechanisms. The access to insurance had significant positive results on the output, which proved it is an essential mitigating strategy against climate change, though, limited literature is available on the Eswatini's perspective.

2.7.2 Smallholder Farmers' Financial Literacy Levels

Financial literacy is an element of human capital that helps improve society members' financial welfare through employing financial services (Kozina & Ponikar, 2015). However, Lusardi & Mitchell (2014) defined financial literacy as an individuals' capacity to process and use economic information to make financial decisions, such as financial planning, investments, debt, and insurance. Kreschovska (2015) added that financial literacy is composed of the ability to ensure personal income, make expenditure decisions, evaluate financial decisions for the present and future and understand the economics of the job market, another key component also for business management.

These findings are in line with Ibrahim *et al.* (2009) who recorded that financial literacy is a measure of how individuals understand and apply financial skills and financial information in their daily decisions for self and business. Remund (2010) observed that its frame incorporated the use of four key components, namely, budgeting, saving, credit, and investments. There is competition between personal financial decisions and those of the farm business in smallholder farming households; hence, it is essential to establish their financial literacy level and how it impacts farm enterprises' success.

Isomidinova & Singh (2017) applied Regression Analysis to assess the level of financial literacy in Uzbekistan. They argued that financial literacy was dependent on financial education, financial socialization agents and money attitude. The results showed that financial education was highly influenced by financial literacy while money attitude was

positively affected by the FL level; financial behaviors improved with more exposure and partaking in social learning opportunities. This is in line with Wagner (2015) who also recorded a positive link between budgeting, saving and financial, social learning opportunities. Currently, there is no available information on Eswatini's smallholder farmers' financial literacy and how their decisions impact the farm enterprise.

Tonui (2017) reviewed theories on liquidity, adverse selection, and organizational theory to establish financial factors influencing farm growth of the horticultural sector in Nakuru, Kenya and argued that farm growth is influenced by liquidity, credit working capital and cash-flow management. Significant factors observed were working capital, access to credit and cash-flow management, while liquidity was the least contributing factor. These results emphasize the need for farmer financial literacy in fueling farm growth and efficiency. This study has conceptualized farm efficiency and farmer FI as determinants of farm performance because these are key informants of farmer decision-making capacity. Figure 2.3 presents the envisaged smallholder farmer financial integrations per the needs of farm enterprise management.

2.8 Alignment to National, Regional and Global Strategies/Imperatives

The Swaziland National Development Plan [SNDP] (2013) details the agricultural development sector in four aspects. It identifies agricultural development as a central strategic area for economic transformation and the improvements for development, and these include high productivity of production factors; commercialization on agriculture of customary tenure; rational allocation and utilization of land; as well as diversification and intensification of high-value crops and stocks. Another aspect is the water resource development for irrigation through efficient use

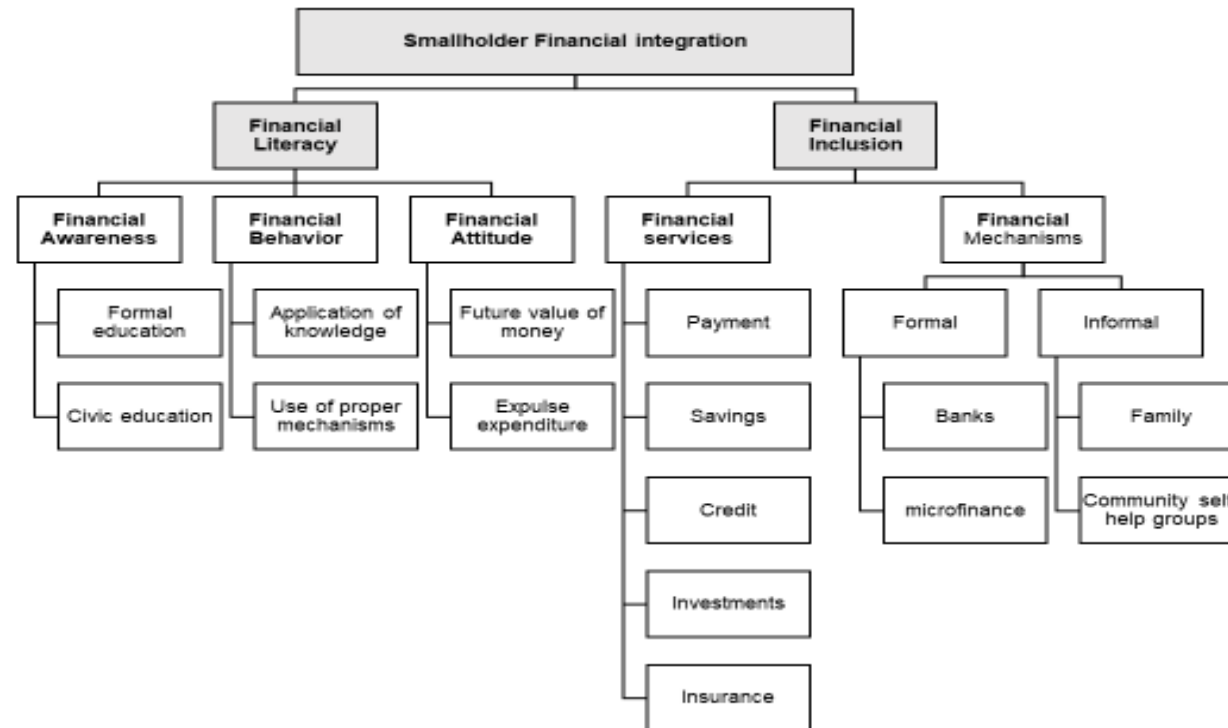


Figure 2. 3: A smallholder Farmer Financial Integration Framework (source: own survey)

of water and financing to promote irrigated agriculture. Rural development is captured through entrepreneurship development, access to credit, and equity financing for smallholder farm businesses. Using the financial services development policy that emphasizes the savings and credit payment. The strategy is devoid of enablers for smallholder farmers' financial literacy through capacity and knowledge.

A review of the National Development Strategy [NDS] resulted in the National Development Plan [NDP]: 2019 -2022. It is an economic recovery plan incorporating the 2022 vision of the First World Status. It celebrates the exploration of high-value crops and the formation of a needed regulatory framework for its success, including the continued investment into earth dams and large dams for smallholder irrigation schemes. However, challenges recorded include the intensity of drought on rain-fed agriculture; no insurance against disasters as risk management for growers; high production costs that ware producer margins; and forced exit of smallholder growers and insufficient land administration for results-orientated policies. For economic recovery, the vision is inclusive growth and development and superior quality of life for all citizens. Related to Sustainable Development Goal Number 1 targets eradication of poverty; aiming improved competitiveness, creativity, and technological innovations to produce adaptation and resilience towards Sustainable Development Goal Number 8 on industry innovation and infrastructure development. Sustainable Development Goal Number 2 targets zero hunger, respectively.

Intended is sustainable growth through export growth, strengthening the business environment, entrepreneurial development, and import substitution; thereby, creating decent work and economic growth for all, Sustainable Development Goal Number 8. The National strategic Roadmap 2019 - 2022 recognizes the limited focus on strategies that enhance exports and economic development within the government (ESRM, 2018). It aims to focus on private sector growth to boot outcome orientation. The target sector for economic recovery is agriculture and agro-processing, among others. The objective is inclusive growth through the facilitation of export-driven growth and smallholder farm High-value market integration. Inclusive development upholds structural transformation through enabling productive capacities, productivity, FL, sustainable agriculture, and reduced inequality (UNDP, 2018).

One smallholder farming sector developed and supported by the Eswatini government for the export market is the baby vegetable production sector since 2003. It uses smallholder irrigation schemes, and the product is sold to the pack-house, which then distributes the produce into the export market. Eswatini, as an integral part of the Southern African Development Community (SADC), is among the ten countries with FL strategies. In its dictates are the financial indicators

for agricultural finance and rural development. SADC (2019) lists financial product use indicators to include remittances on elevated platforms, MM, saving rate and mechanism used, credit access rate and the modes used, and the ownership of and use of formal insurance mechanisms. SADC (2019) further lists three major agricultural finance indicators in Eswatini which include enabling market and value links; appropriate and affordable financial products; and screening of enthusiastic farmers. Complementary is the rural development indicator which also targets improved financial access points, cost-effective and quality financial mechanisms, and the improvement in financial literacy of marginalized communities. The SADC (2019) FL forum reported that the programme of the current one has not successfully extended beyond the urban centers, limiting rural development and smallholder agriculture.

2.9 Summary of Literature Review

This literature review chapter provided an overview of the gaps in inclusive VCD. It demonstrated how the smallholder farming enterprises are organized, the challenges encountered in producing for distant markets, and the technical assistance requirements for maximum benefits. It showed that interventions into smallholder production are essential as farmers are resource constraint, lack market information, isolated from market and input suppliers, and grow more than one crops at a time. The gaps reflected the extent of the need to increase rural smallholder farmers' capacity to be good enterprise managers to make proper decisions on the allocation and use of farm resources to realize profits. However, a gap was identified in the development of smallholder farmers to effectively manage their enterprises through building their financial knowledge to excel in financial resource management as observed in physical resource management. The concept of FL brings forth the need for enabling farmers' capacity to use the full basket of financial services to benefit their enterprises. However, most interventions have targeted enabling credit use than savings, transfers insurance and investments. There is a gap in the literature on liquidity management and the financial literacy of smallholder agri-entrepreneurs, especially those in baby vegetable farming. While literature records smallholder farm development intervention in other crops, no study has been conducted on smallholder farmers in high-value perishable crops in Eswatini other than on field crops like sugar cane. Therefore, this study sought to develop a model by which smallholder farming interventions can impact financial resources' efficiency. A review of methodologies brought forth more insight into the questions and objectives of the study. As a result, it permits the adoption of methods for the research and variables essential for attaining study objectives.

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CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction

The purpose of this chapter is to elaborate on how the study was conducted to achieve the set objectives. There are four main systematic subsections of this chapter. These include study area, research design, data collection and data analysis. Included also is a detail of the ethical considerations that were made in this study. A map of Eswatini and the location of the study areas are provided. The aim was to establish farmer and farm enterprise dynamics and their impact on performance outcomes of the smallholder baby vegetable farming sector.

3.2 Description of the Study Area

3.2.1 Eswatini Country Context

The study was conducted in Eswatini, a landlocked country located between South Africa and Mozambique. The country is 17 364 km² and has a population of about 1.2 million (World Bank, 2019). However, about 70% of the population live in rural areas and depend on agriculture for livelihoods (World Bank, 2019). Eswatini has 283 483 households, 12,5% of these are classified as extremely poor, and 20% of the overall population is extremely poor (NDP, 2019-2022). The absolute poverty line for food and non-food items is E975 per person per month while for the poor it is E463 per person per month (DPMO & UNICEF, 2018). The working class consists of 56.9% of the population while unemployment is at 23% with seasonal unemployment at 8%. The agriculture and forestry industry contributed 7.4% of the GDP in 2015 (Central Bank of Eswatini, 2016), which makes it a significant sector to the country's economy. The rural population access to electricity stands at 67%, 20% undernourished and the population growth rate is 0.7%.

Baby vegetable production in Eswatini dates to the late 1990s and continues to gain an increasingly significant share of the export market. According to European Union (EU), smallholders supplying NAMBoard export the produce primarily to the EU and South Africa. In 2020, NAMBoard recorded demand for baby vegetables to be five tonnes per year, translating to EUR 2.4M (EU, 2020). This demand is predicted to increase in the EU, the Middle East, the Indian Ocean, west and central Africa, and the Southern African Development Community (SADC) region, especially in South Africa (Dhladla, 2019).

Eswatini is endowed with a diverse microclimate that enables the production of different vegetables all year round. The country has four agroecological zones characterized as moderate, near temperate sub-tropical and semi-arid (WB, 2011). The nation's four agroecological zones, abundant fertile soils and adequate water supply enable Eswatini to grow baby vegetables all year round for local supply and export throughout the year, giving the country a comparative advantage against its competitors (Sikora *et al.*, 2019). Furthermore, Eswatini has lower labour costs and abundant supplies of unemployed labour, which increases its opportunity for private sector investment and adds to the country's comparative advantage (WB, 2011).

Production in Eswatini is promoted mostly in two central administrative regions: Manzini and Hhohho. Both commercial large-scale producers and smallholders participate in baby vegetable production. The profitability of baby vegetable production may be affected by high input costs and marketing costs, making baby vegetables relatively expensive to farm and sell. Consequently, baby vegetables are often produced by emerging and large-scale producers with the technology required for this industry, while smallholders are supported through government extension services. Produce is mainly for exports through NAMBoard or sold directly to local traders (Dlamini *et al.*, 2020). Also, the highly perishable nature makes transportation, post-harvest management, and short shelf-life challenging (Mangwe *et al.*, 2020).

Map of sampled Rural Development Areas (RDAs) in Swaziland

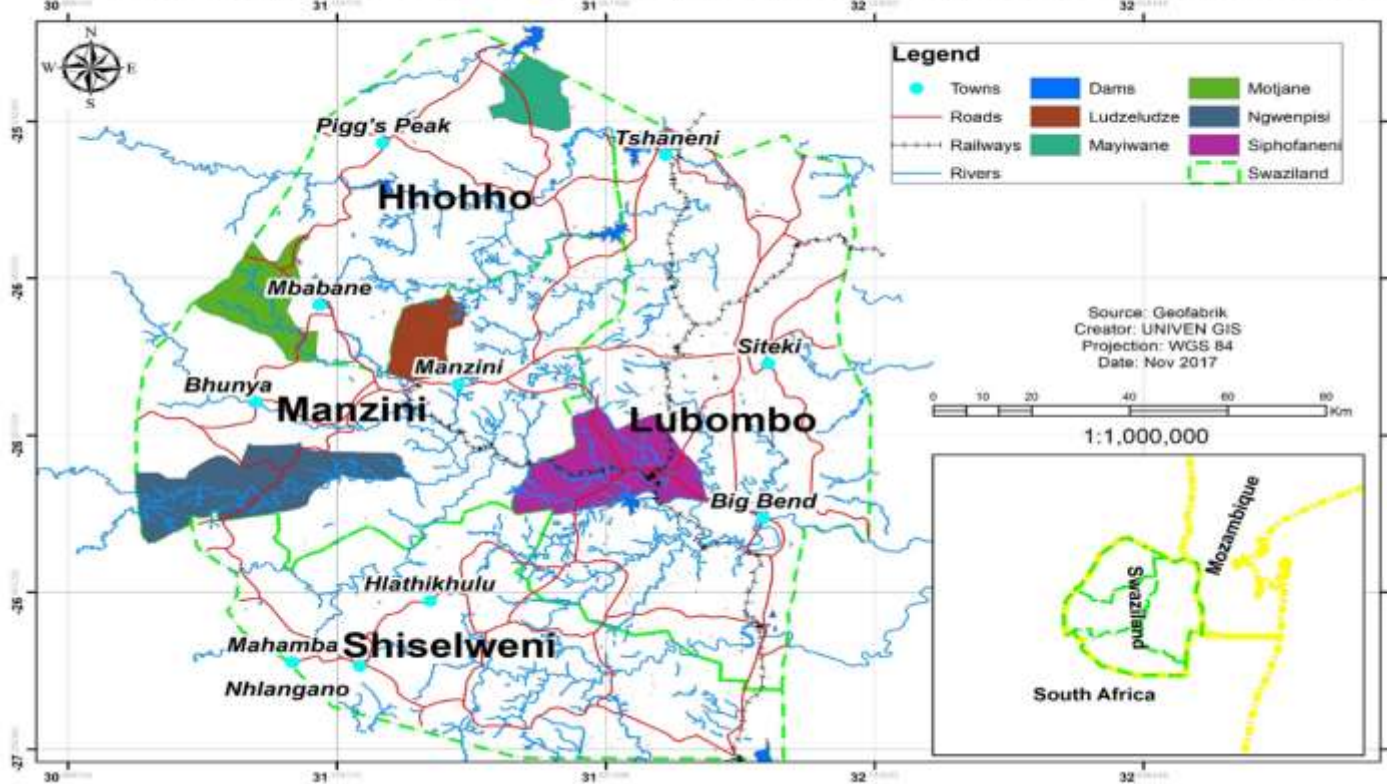


Figure 3. 1: Map of Eswatini showing the five Constituencies under study (Source: Geogabrik, 2017)

The Kingdom's Strategic Roadmap 2019-2022 emphasizes commercializing the agricultural sector and aligning the country toward an export-driven economy. The goal is to shift smallholders from subsistence farming toward commercial farming (GoE), 2019) through improving the integration and participation of small holders in markets. Improving productivity in niche markets for high-value horticulture crops such as baby vegetables have the potential to achieve this vision (Mangwe *et al.*, 2020). According to NAMBoard, baby vegetables are one of the leading crops dominating the export market (NAMBoard, 2021). Thus, producing more baby vegetables would reduce high import rates and increase the country's foreign capital and smallholder income returns.

3.2.2 Smallholder Baby Vegetable Value Chain in Eswatini

Figure 3.1 presents the map of Eswatini indicating the five sub-rural development areas in the five constituencies where the farmers are found, namely, Mayiwane, Motshane, Ludzeludze, Ngwempisi and Luve RDAs. The Hhohho irrigation scheme growers were 116.3km from the pack-house while Manzini irrigation scheme growers were 68.9km. Figure 3.2 presents an illustration of the flow of functions in the smallholder baby vegetable farming sector, showing the actors in each stage of the value chain (VC) as the support from external stakeholders. There were eight functions identified in the sector, and these: input supply, production, storage and handling, transportation, grading and weighing, processing, trading, and consumption.

Input supply

Input supply is a function that is executed by the buyers and local traders in agricultural supplies. Traders were found in all regional towns and respondents used them for fertilizer and agrochemicals. The seeds were exclusively supplied to the growers to ensure quality for the market, and input access is afforded by the buyer through an input credit scheme that enables input purchases like FINCORP, a microfinance institute that had afforded credit to some private growers. This credit was meant for infrastructure development and operational requirements, and insurance was afforded to credit users as a recovery strategy. The insurance only covered

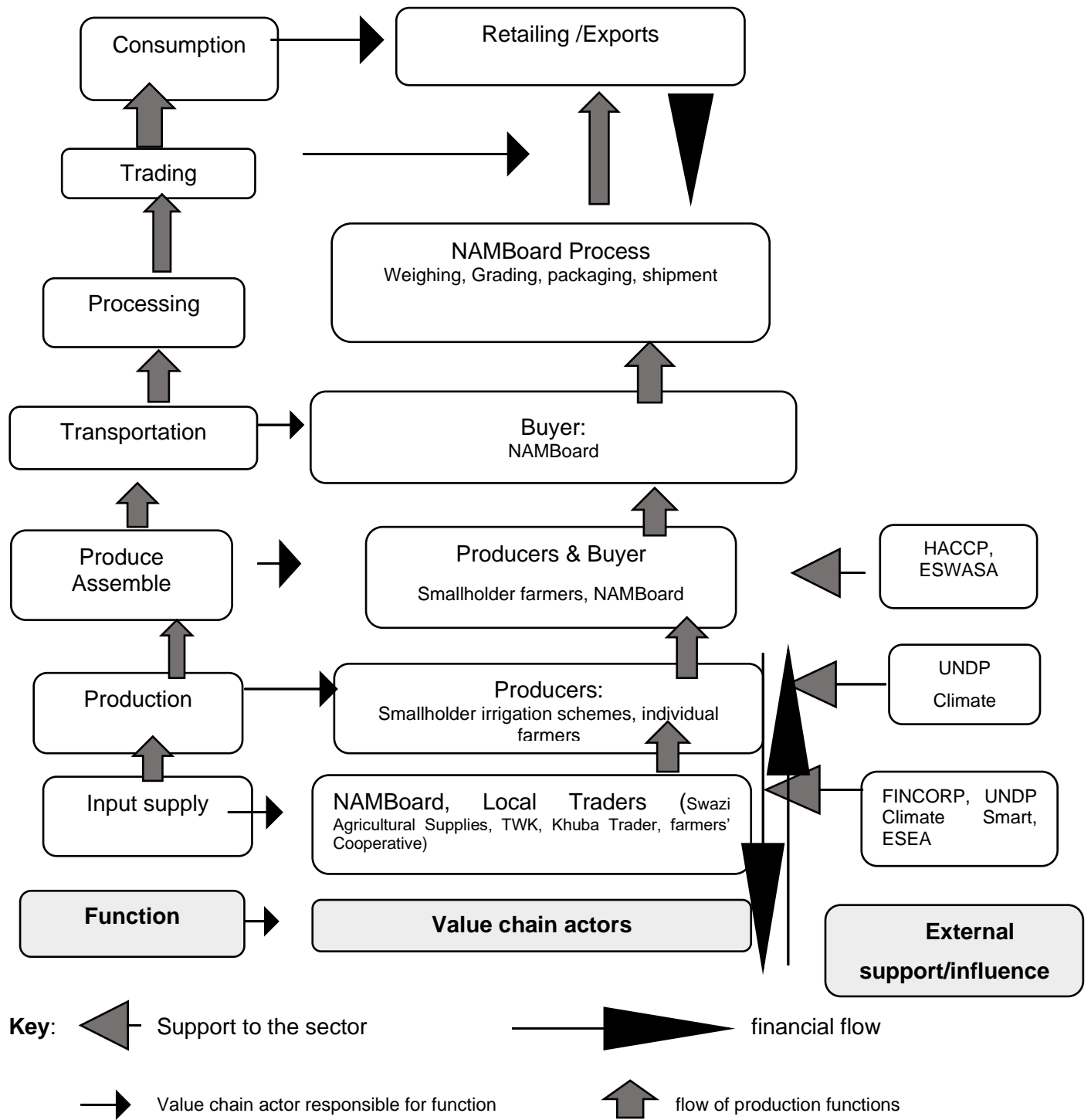


Figure 3. 2: Baby Vegetable Production Value Chain (source: own survey)

input requirements, not crop cover. UNDP-Climate Smart Agriculture Funding from COMESA, a two-year up-scaling project, started in August 2019. It provides growers with an operational revolving fund aimed at providing for labour and tractor hour requirements.

Production

Production was on the traditional land tenure system and the smallholder irrigation schemes depended on the government for capital development, which consisted of water damming, channelling as well as fencing of the fields. The respondents provided for operational capital requirements. Production was done under sprinkler, drip, and furrow irrigation. The use of water sourced from rivers, boreholes, and perennial streams allowed for all-year-round production. The government tractor pool in local RDAs provided for tractor and implement requirements. There were also private tractor owners that served the industry, but at a higher price than the government. Planting and weeding were done manually, including harvesting of the product. The buyer provides extension services to the sector in collaboration with RDA extension. Climate Smart Agricultural Funding through the revolving fund enables proper record-keeping for input purchases and use for the growers under irrigation schemes. The respondents were equally exposed to various empowerment workshops targeted at improving production. The training was organized by the National Marketing Board (NAMBoard) Development unit and was hosted in the various farmer locations.

Product Assemble and Transportation

Respondents had grower contracts with the buyer, the NAMBoard, which stated that the buyer will be collecting the produce after harvest from the produce farms. This undertaking was more pronounced in the irrigation schemes and respondents within the central Manzini region delivered their produce to the buyer. The buyer provides crates for bulk packaging of the products for transportation. Name tags were used to label crates by farmer identity as transportation is collective and these are colour-coded by each region. They are then tied to the crates after filling in the producer information. Farmers receive delivery notes from drivers (a record of the product collected) that show only the number of crates and product type.

The buyer owns a pack-house that is Hazard Analysis and Critical Control Points (HACCP) certified to receive product deliveries and process them for the market. The Eswatini Standards Authority develops quality standards of local industry requirements, including HACCP. The pack-house also undertook product warehousing for trading. The distribution is into supermarkets and the export market. Local consumption of baby vegetable is still low. Farm-level crop sales were limited by the consumption preferences of locals, they still preferred conventional to baby vegetables.

3.3 Research Design

A research design is a plan of how to proceed in determining the nature of the relationship between variables under a study. In this study, therefore, a Sequential Integrated Mixed-Method Research Design was used to achieve the set objectives. It is also known as the Third Methodological Orientation. It combines the strength of Qualitative and Quantitative research to collect and analyze both strands of data separately, integrated and sequentially triangulates results to address the research question (Berman, 2017). Mixed methods use mixed analysis too, therefore, anchored on the strengths of qualitative and quantitative methodologies (Onwuegbuzie & Combs, 2010). As noted by McKim (2015) mixed methods help in understanding a complex phenomenon by permitting the researcher to articulate and explain the findings. This provides a balanced view of the study (Morse & Chung, 2003) which is desirable and needed for future research (Schulze, 2003). Therefore, both Qualitative and Quantitative research techniques were used in this study. Figure 3.3 presents the two phases of sequence in the data collection and data analysis where the triangulation phase integrated both the quantitative and qualitative data strands for the synthesis.

3.4 Population and Sampling Procedures

This study targeted smallholder irrigation farmers producing baby vegetables in the Kingdom of Eswatini during the 2018/2019 farming season. The respondents were selected the two major regions, Manzini and Hhohho regions, where baby vegetable predominantly produced (NAMBOARD, 2015). The selected farmers were categorised into two major irrigation schemes: the *Mavulandlela* Irrigation Scheme in Hhohho and *Mlobane* Irrigation Scheme in Manzini. The respondents were selling through the sole buyer, NAMBoard, which is a government-owned pack-house located at Ncabeni in the Manzini region. Multi-stage sampling was used to conduct

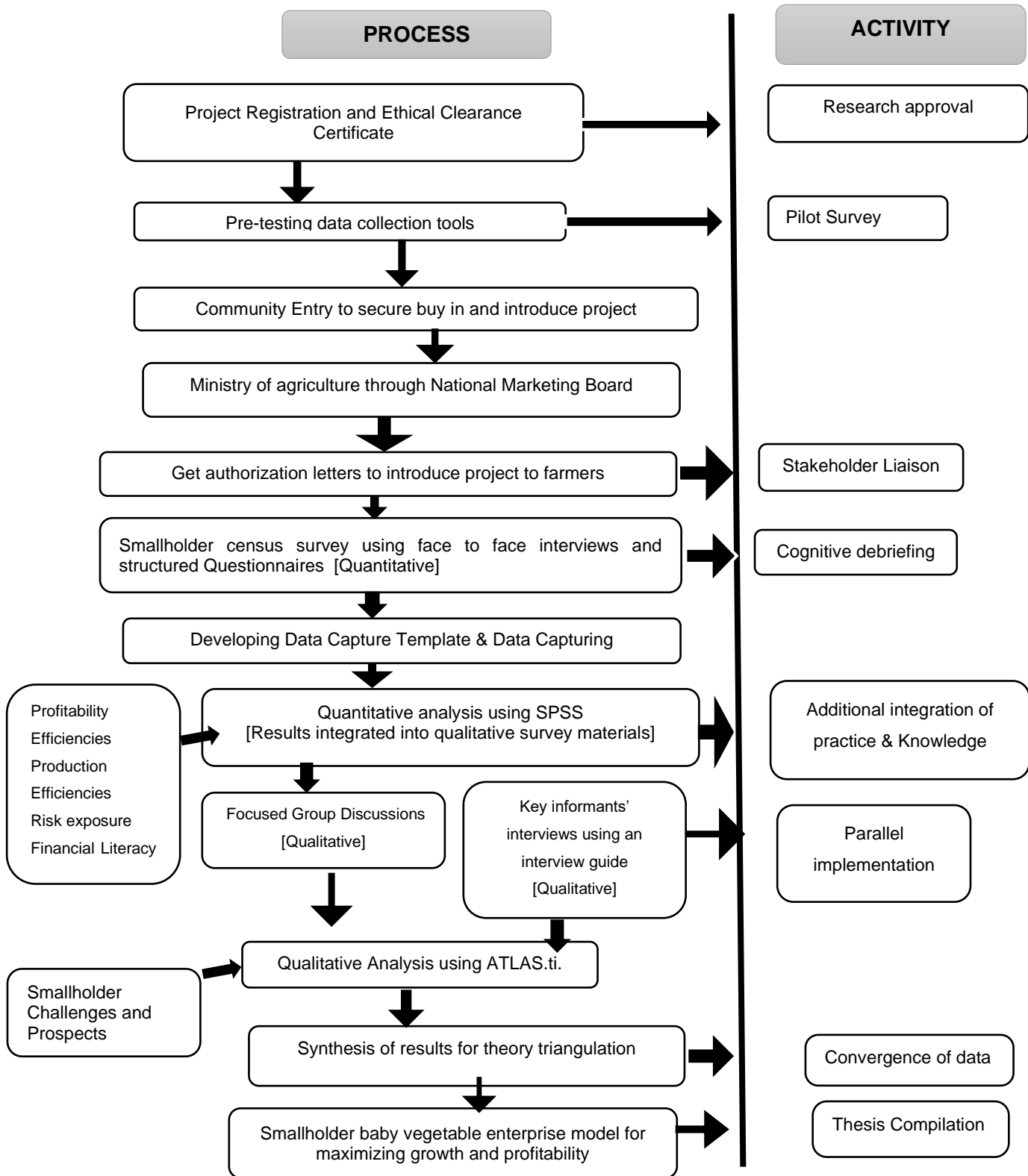


Figure 3. 3: Application of Sequential Mixed Methods Research Design (source: own survey)

a census of all current baby vegetable growers within the two irrigation schemes for quantitative data. These stages enabled the identification of growers within each stratum and the categories included: region, RDAs, commodity group and irrigation scheme. Snowballing was used to identify private growers at the village level. Qualitative data was gathered from twenty-eight smallholder growers and eleven key industry informants.

3.5 Data Collection

A list of current growers was obtained from the NAMBoard through the extension officers. The officers also assisted in locating and organizing the growers for the data collection exercises. The data collection process followed the Sequential *Quant-Qual* Approach where quantitative data results inform the qualitative data to be collected to strengthen the results. Therefore, two data collection phases were used. A team of four graduates from the University of Eswatini were employed and trained to assist the researcher in the data collection process. They were trained on the structured questionnaire, the interview guide as well as on the FDG and its tools.

The quantitative data was collected using a structured questionnaire administered through face-to-face interviews. Though a total of sixty-nine questionnaires were administered, twelve questionnaires had to be discarded based on incomplete and inconsistent information provided. Finally, a total of fifty-seven responses formed the total number of respondents for quantitative data for the study. Data collected was primarily on the farm characteristics, farmers' demographics, production costs, enterprise risks, yield and sales proportion, product collections, farmer affiliations, financial services used and literacy levels.

The second phase of data collection sought to gather qualitative data. Key informant interviews and focused mini-group discussions were used. The key industry informants consisted of stakeholders directly working with and affecting smallholder baby vegetable production in Eswatini. Eleven respondents were purposively selected through their level of interaction with the smallholder baby vegetable growers, and these included three input suppliers, two professionals, two financiers, two private growers and chairpersons of the two grower schemes.

The grower focused mini-group discussions used both irrigation scheme members and non-members in the two regions. FGDs are fundamental in evaluating the effectiveness of interventions as well as creating a platform for farmer-to-farmer learning (Ortalani *et al.*, 2017). Therefore, seven focused mini-group discussions were held in the two regions, and on average

each group had four members because smaller discussion groups are sensitive to group dynamics thus providing greater in-depth discussion with less moderator involvement (Morgan, 1997). However, Morgan further advised that the objectives and research constraints be accounted for when deciding group sizes. Heterogeneity within the group determined group sizes, and these include included: gender, irrigation scheme management and region. For this study, a total of twenty-eight growers participated in the discussions.

The discussion process followed a FGD guide where a list of individually recorded constraints during face-to-face interviews was used. The respondents ranked these by the level of perceived significance in enterprise management. Upon ranking, respondents then gave a justification of the most important constraint as well as a solution to alleviating it. This provided a semi-structured approach to the discussions and centralized discussions for the desired change. An insight into the highly rated constraints and a solution was an interpretive approach to understanding respondents' experiences. For this study, therefore, both quantitative and qualitative data were collected.

3.6 Data Analysis

The use of mixed methods for data collection enabled results integration to identify new insights that would have otherwise not been captured where a mix of methods was not used. Fetters *et al.* (2013) agreed that integration can occur at multiple levels of the study through connecting, building, merging, or embedding the data. This can be at the research design level, choosing data collection methods, at the results' interpretation stage; also, interpretation-integration (Vedel *et al.*, 2019), where a joint display of results from both qualitative and quantitative data is used to bring new insights into the results that could not be captured on the use of methods separately (Fetters *et al.* 2013). The details of the model specifications for each objective are given including tests of validity. Key questions for each step in the sequential data collection were informed by the gaps in findings towards a holistic understanding of the research phenomena.

Triangulation was used to synthesize the results in chapter eight, where the proposed framework is presented. Techniques of data mining as adopted by Guetterman *et al.* (2015) merged quantitative and qualitative data through statistics-by-the-themes and parallel

contrasting to link results to the theoretical framework using visuals. However, Turner *et al.* (2017) used triangulation as the process that enables multiple research strategies to be used together in the research to accomplish the target theoretical purpose. Therefore, in the synthesis of the model results, convergent triangulation was used (see Figure 3.3).

3.6. 1 Details of Methodology by Objective

Objective A: To establish the level of production efficiency of smallholder farm enterprises

A descriptive analysis of the characteristics of the farm and growers was undertaken to present who is producing baby vegetables and how they are producing. Enterprise analysis were adopted to summarise the cost and returns of the enterprises, thereafter efficiency analysis were conducted.

Characterizing The Baby Vegetable Farming Systems Through Enterprise Analysis

Objective A sought to describe and capture baby vegetable cropping system variability in the respondents. The following equations (1, 2, 3, 4, and 5) were adopted to estimate costs and returns as adopted by Hagos & Bekele (2018); Rugube *et al.* (2019) and Saediman *et al.* (2019):

$$\text{Gross Cost} = \text{Total Variable Cost (TVC)} + \text{Total Fixed Cost (TFC)} \dots\dots\dots (1)$$

$$\text{Gross Return} = (\text{Quantity of produce} \times \text{Prevailing price of produce}) \dots\dots\dots (2)$$

$$\text{Net return} = \text{Gross return} - \text{Total cost} \dots\dots\dots (3)$$

$$\text{Cost-Benefit ratio} = \text{Total revenue} \div \text{Total cost} \dots\dots\dots (4)$$

$$\text{Operating expense ratio} = \text{Operating expenses} \div \text{Gross Revenue} * 100 \dots\dots\dots (5)$$

Variable costs included were fertilizer, seeds, chemical, labour in person-hours, irrigation costs and transport, and these were expected to negatively influence returns (Hagos & Bekele, 2018). Considerations were made to the yield in kg of harvest, total income, total variable costs of production, and the gross margin. These were contrasted in relation to smallholder categories by irrigation scheme membership for its influence on variations in production.

There were three groups, namely, clustered, semi-dependent and private irrigations scheme growers. After testing for normality of data, the Broferri analysis was used other than paired analysis since the categories in the sample were more than two. The S - N - K tool in ANOVA was adopted in grouping the insignificant groups into one unit for a large sample comparison. The categories had unequal populations and unequal variances therefore the use of the Welch and Turkey *post hoc* test helped identified the groups that had significance variances.

Production Efficiency Analysis

The efficiency analysis adopted the Stochastic Frontier Analysis, to broaden the understanding of the effects of unobserved noises and structural model specification on the results of this group.

Technical efficiency is an economic efficiency measure seeking to measure the ability of the producers to produce the highest level of output given the technology and inputs at hand (Farrell 1957; Coelli *et al*, 2005; Hong & Yabe, 2015). It is measure based on quantities used and harvested without introducing the prices and can be classified into three components. These are the scale efficiency, congestion, and the pure technical efficiency (Farrell, 1957). Measuring technical efficiency is to use inputs and output quantity without introducing their prices. It can be decomposed into three components such as: scale efficiency, congestion, and pure technical efficiency. Scale efficiency refers to the potential productivity gain from achieving optimal size of a farm while congestion efficiency is when the increase in some production inputs could cause output to decline (Farrell, 1957).

Stochastic frontier analysis (SFA) is an econometric approach used in efficiency measurements. It was developed by Aigner *et al*. (1977) and Meeusen & van Den Broeck (1977). It is a parametric method that enables distinguishing between the effects of model misspecification from the effects caused by inefficient use of farm inputs (Coelli *et al*., 2005). Ability to separate these effects is a necessary when interventions to farm performance are sought, unlike the data

enveloping analysis that is non-parametric and does not distinguish the noise effects of the results presented. The SFA is also suited for single input-single output production therefore, suited to adopt for the assessment of the smallholder baby vegetable enterprises.

The SFA production model specification is given in equation 6.

$$Y_i = f(X_{ij}; \beta) + \varepsilon_i \quad \dots\dots\dots \text{equation 7}$$

Where;

Y_i = farm output,

X_{ij} is a vector of inputs used in each farm for production,

ε_i = composed error term ($v_i - u_i$).

The two components of the error term v_i and u_i are independent of each other. U_i is a one-sided efficiency component ($U_i \geq 0$) representing the farm technical inefficiency (Coelli *et al.*, 2005). U_i can be a half-normal distribution, exponential or a gamma (Aigner *et al.*, 1977; Meeusen & van Den Broeck, 1977). While the term v_i is two-sided ($-\infty < v_i < \infty$) and normally distributed random error ($v_i \sim N [0, \delta_v^2]$) representing the stochastic effects that cannot be controlled by the farmer. These include the weather, natural calamities, and change.

The estimators of β , δ and γ are given by the maximum likelihood analysis of equation (7) and β is the vector of unknown parameters.

$$\gamma = \delta_u \div \delta_v \quad \dots\dots\dots \text{equation 8}$$

$$\delta^2 = \delta_u^2 + \delta_v^2. \quad \dots\dots\dots \text{equation 9}$$

Therefore, the ratio of the variance parameter γ which presents the variability of U_i to variability δ^2 is given in equation 9.

$$\gamma = \delta_u^2 / \delta^2$$

... equation 10

such that γ is greater than 0 but less 1.

When the value of λ is equal to 0, it shows that the actual farm output level and the efficient output level is entirely due to statistical noise. However, a value equal to 1 represents varied attributes of farm enterprise performance given the inefficient use of technology (Coelli *et al.*, 2005). Therefore, a fully efficient farm has TE equal to 1 and a fully inefficient farm would have zero TE value. To determine an individual farm inefficiency level, use the conditional distribution of U_i given the fitted values of ε_i and the respective model parameters (Jondrow *et al.* 1982; Bassette *et al.*, 1988). The assumption is that through the independency of v_i and u_i , the conditional mean u_i given ε_i is specified by equation 11:

$$E(u_i|\varepsilon_i) = \delta * \left[\frac{f(\varepsilon_i \lambda / \delta)}{1 - F(\varepsilon_i \lambda / \delta)} - \frac{\varepsilon_i \lambda}{\delta} \right] \quad \dots\dots\dots \text{equation 11}$$

Where:

$$\delta^{*2} = \delta_u^2 \delta_v^2 \div \delta^2$$

f^* = the standard normal density function,

F^* = the distribution

F^* and f^* are estimated at $\varepsilon \lambda / \delta$.

Given the half-normal model, a z-test for examining the presence of technical inefficiencies is then employed to test the hypothesis (Coelli *et al.*, 2005):

$$H_0: \lambda = 0$$

$$H_1 = \lambda > 0$$

$$Z = \frac{\check{\lambda}}{se\check{\lambda}} \sim N(0,1) \quad \dots\dots\dots \text{equation 12}$$

Where:

$\check{\lambda}$ = the maximum likelihood estimator of λ

$se\check{\lambda}$ = the estimator for the standard error.

As Weldegiorgis *et al.* (2018) recorded that the optimal allocation of land, labour, fertilizer, water, and other farm resources enables the efficiency of the farm enterprise and helps on

maximizing the returns. Farm benefits are maximized when efficiency drives the use of cost effective's methods of production and promotes sustainability of resource use in the farm. An efficient farmer allocates land, labour, seed, fertilizer, water, and other resources in an optimal manner to maximize productivity at a least possible cost combination of production and on a sustainable basis.

An efficient allocation of productive resources ensures improvements in producer incomes. This study adopted the Production Function Frontier Analysis of TE as used by Baruwa (2018). The specification of the empirical model followed the Cob-Douglas functional form with six independent variables, refer to Equation 13.

$$\ln Y_i = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \varepsilon \quad \dots \text{Eq (13)}.$$

Where - \ln = natural logarithm

Y_i = total output (kg/ha) for each farm, where $i=n$

X_1 = Total Seed rate (kg /ha)

X_2 =Total fertilizer rate (kg/ha)

X_3 = Total tractor hours (hours/ha)

X_4 =Total amount of agrochemicals used (litres/Ha)

X_5 = Total labour used (man hours/ha)

X_6 = Land size in hectares (ha)

β_0 = constant, β_i = coefficient for the i^{th} input, called the production elasticities.

$\varepsilon = V_{ij} - U_{ij}$

Y_i = total output (kg/ha), subscript i denotes the i^{th} baby vegetable farmer and j^{th} input, respectively. $B_{0, 1, \dots, n}$ = vector of unknown parameters and $\varepsilon = V_{ij} - U_{ij}$ is the error term where; V_{ij} = statistical noise and production risks beyond the farmers' control, asymmetric component capturing variations in output caused by factors outside the farmers' control (Baruwa, 2018) and U_{ij} = non-negative production factor that can be controlled by the farmer (inefficiency effect), a one-sided efficiency component associated with the technical efficiency (TE) of the baby

vegetable production and represent the variation in output caused by socio-economics characteristics of the farming operations (Baruwa, 2018).

A priori expectations of the model were that parameter estimates for farm size, seed quantity, labour used, fertilizer, and chemicals would be positively related to farm output (Okon *et al.*, 2010; Sujan *et al.*, 2017) measured in kg/ha. TE uses the quantity of inputs used on a unit scale against harvest while the allocative efficiency (AE) uses the budgetary allocation where the value of inputs used per value of output recorded on a unit scale (per hectare). The two measures enable the evaluation of the enterprise management capacity to allocate and use resources to generate farm benefits.

Farrell (1957) defined economic efficiency (EE) as the product of TE and AE (see Equation 14).

Such that.

$$EE = AE * TE \quad \dots \text{equation (14)}$$

Because the efficiency scores from the SFA are censored between 0 and 1 the Tobit regression model is used in the analysis. Following the guide from Tobin (1958), the factor Tobit regression is specified in equation 15.

$$EE_i = \delta_0 + \sum \delta_i W_i + \epsilon_i \quad \dots \text{equation 15}$$

Where;

EE is the economic efficiency score of each farm, a dependable variable and resultant from equation 15,

δ_i = vector of unknown parameters to be estimated for the *i*th factor,

W_i = variables representing the socioeconomic of the respondents and farm characteristics (factors).

Table 3. 1: Definition of variables used for Efficiency Analysis.

Variable	Definition	Unit of measure
Output	Yield recorded and sold at value from the enterprise	Kilograms per hectare
Seed quantity	The volume of seeds used for the various baby vegetable crops in the land allocated	Kilograms per hectare
Fertilizer quantity	The total amount of the different types of fertilizer used on the harvested produce	Kilograms per hectare
Labour	Total man-hours used in the production of the harvested produce	Man-hours per hectare
Tractor hours	Total tractor hours used in the farm on the various aspect of the production of the crop harvested	Hours per hectare
Agrochemicals	A total volume of agrochemicals in the production of the crop harvested.	Litres per hectare
Land size	The total area allocated and used for the baby vegetable production in each farm	Hectares

Therefore, regression was used to determine the factors influencing farm enterprise efficiencies in the sector. The maximum likelihood estimate's function used the six farm inputs per Table 3.1 for TE and AE used the production cost function. Economic efficiency as product of TE *AE. For the factors influencing the economic efficiency, the socio-economic and farm characteristics

were used. These include the age of farmer (years); household size (number); gender of farmer (1=female); land size used (hectares); years of formal education (years); experience in baby vegetable production (years); trained in baby vegetable production (1=yes); access to extension services (1=yes) and number of crop species grown.

The group's production scale efficiency represents whether the size of enterprises uses the best practices to realise the highest output from the give cost level from the farm operations. The summation of the production inputs' elasticities gives each enterprise's scale efficiency (Hong & Yabe, 2015; Tavva *et al.*, 2017; Nguyen *et al.*, 2017; Vashandass *et al.*, 2018). The scale efficiency, which is less than 1, reflecting decreasing returns to scale, while above one shows increasing returns to scale. Equal to one is constant returns to scale.

The gamma is $\gamma = 0.00$ ($p < 0.001$), presenting those inefficiencies exist in the allocation of costs in the smallholder baby vegetable process. Therefore, the cost function is essential in the explaining inefficiencies in budget planning and implementation. The Sigma Square (δ^2) is also significant ($p < 0.01$), showing the correctness of the specified distribution of the Composite Error Term ($v-u$) in the Cost Frontier Function.

The production scale efficiency of the group was computed as adopted by Nguyen *et al.* (2017) through the summation of the elasticities of the production inputs (Hong & Yabe, 2015; Tavva *et al.*, 2017; Vashandass *et al.*, 2018). This is a measure of economies of scale of the enterprises presenting the position of the growers on the production curve. It shows whether the present scale of production can benefit from the use of additional input quantities. A production-scale efficiency value, which is less than 1, reflects decreasing returns to production scale, while a value above 1 show increasing returns to production scale. The value one represents constant returns to enterprise scale of production. The evaluation of cost allocation using the cost frontiers permits the summation of elasticities to measure if the farm enterprise can benefit from cost -saving methods or an expanded input budget thereby positioning the enterprise of the production curve. This guides enterprise management using the diminishing returns to scale of production (Kay & Dufy, 2015).

The significance of the log-likelihood and sigma square in all efficiency functions, qualified the used of SFA method for the results of production efficiencies in this study. H_0 is rejected, production inefficiencies exist in this group.

Objective B: To characterize the challenges of venturing into smallholder baby vegetable enterprises.

Methodology for this objective B is discussed in two parts, B1 on risks and B2 on constraints.

B1: To determine the risks associated with smallholder baby vegetable enterprises.

A combination of quantitative data was used for risk analysis where risk variables were both production and market related. Table 3.2 below shows the risk variables considered in this study. A Likert scale was used to rank risk exposure where 1= *not likely*, 2 = *less likely*, 3 = *not sure*, 4 = *not sure*, and 5 = *more likely*. This scale sought to establish risks experienced by farmers in the past three years to determine risk prevalence in the region and to the different classes of irrigation scheme membership. To collect relevant information, three classes were considered: clustered production, semi-dependent production, and private production.

The responses were subjected to Discriminant Analysis (DA) for classifying risk variability exposure and risk probability for each cluster. The three categories of scheme membership were used, and each group risk probability was computed. The risk factors were classified as either market or production risk, or the risk prediction for each category was established. The classification using DA, and the variation by irrigation scheme membership was a significant discriminant factor in risk exposure and risk probability in the group. DA is a predictive classification method developed by Fisher in 1936. It allowed the growers' scheme membership to be segregated based on their risk experiences. Risk factors with a mean rank above 3 were considered highly loading factors to discriminate the risk exposure of the group. Therefore, these risk factors were used as an explanatory variable and irrigation scheme membership was used as the dependent variable.

The aim was to ascertain if the different production settings experience significant differences in risk factors. López-Ortega *et al.* (2016) used DA for classifying small business enterprises based on their knowledge level. The three classes of small business enterprises used include: those with technical problems, those with planning and production issues, as well as the knowledgeable and capable of managing their business well. Similarly, Khemais *et al.* (2016) used Logistic Analysis and DA for credit score and default risk prediction to classify the default rate of applicants. The two methods were significant in predicting the defaulters and non-defaulters equally. The classification analysis, therefore, confirms the proper clustering by using the traits probability to associate with a given group. The objective of this study was to classify smallholder baby vegetable production systems using the farmer risk exposure history.

DA was adopted to classify the respondents according to the risks they experience in the sector (refer to equation 22). Wilks' Lambda values for the risk factors in the covariance matrix had values above 0.5 and statistically significant, no risk factor is equal to 1. The specification of the discriminant function is given below.

$$Z = a_0 + a_1 X_1 + a_2 X_2 + a_3 X_3 + a_4 X_4 + \dots + a_n X_n \quad \dots \dots \dots \text{Equation 22.}$$

Where:

a_0 = constant

a_1, a_2, \dots, a_n = discriminant coefficients.

X_1, X_2, \dots, X_n = discriminant variables, the risk variables of baby vegetable production.

Z = a predictor score used to synthesize the risk factors of baby vegetable enterprises with regards to the variable to explain this value by predicting the probability of default of each enterprise. Therefore, Z is the smallholder irrigation scheme membership. The Fisher test assessed if any significant difference exists among the discriminating factors. A higher P -value indicates higher discriminating power of the risk factor. Moreover, Wilks's Lambda, refer equation 23, assessed the presence of a significant relationship between the irrigation scheme membership and risk factors, and a value closer to zero is most desirable and presents a stronger relationship. The discriminant analysis for this study is validated; it had a non-equal variance-covariance matrix.

$$\text{Wilks's Lambda } (\lambda) = 1 - (\text{Inter-Cluster Variance} \div \text{Total Variance}) \quad \dots \text{equation (23)}$$

The purpose was to show if there is significant variation in the risk's experiences by region and membership to irrigation scheme. The hypothesis test of equality of group means enabled discrimination of risk variability ratios to distil the factors that are distinct to each group. The Box's M test of equality of covariance's matrices assessed if the variance-covariance matrix of risk factors was identical to each other.

Table 3. 2 : Risk Variables at Producer Level

Variable	Production	Market	Score
Sudden change in output price		X	Ranking scale. <i>1 = most likely</i> <i>2 = likely.</i> <i>3 = not sure.</i> <i>4 = not likely.</i> <i>5 = most unlikely.</i>
Sudden change in input price		X	
Sudden change in output	X		
Sudden change in product demanded		X	
Pest and diseases	X		
Sudden change in the wage rate		X	
A prolonged drop in the price of output		X	
Sudden change in labour availability		X	
Product collection failure		X	
Delayed payments		X	

X = indicate the category of Risk

Equality variance-covariance matrix for different clusters is not equal with a large M -value and a significant F -test. Therefore, $H_{a\text{is}}$ adopted which says, the covariance matrix of intra classes is

not equal, *Fisher* is significant at $p = 0.000$. Therefore, the Discriminant Analysis is valid for this study.

The canonical correlation test was used to establish variation between clusters given the total discriminant function. This presented the fraction of variation of the risk function given the differences recorded among each membership cluster. Correlation values closer to one showed more variation among clusters. The number Eigenvalue is the number of clusters minus 1 ($k-1$) = 1 (3 - 1) = 2, where three is the number of scheme membership categories under consideration. Therefore, the results show two risk exposure and two risk probability functions. The canonical correlation was 0.9 for function 1 and 0.51 for function 2 indicating a good model fit. Also, the chi-square test showed the model was significant $0.00 = P < 0.05$. The models functions had high Z for yield change and untimely payment, showing that these are the most discriminating factors between the groups. Furthermore, the discriminating power of risk factors was used to construct the linear predictive relationship of the risk factors for each cluster.

B2: To establish smallholder baby vegetable enterprise constraints to production and supply.

A mixed methods approach on data collection was used. First, a structured questionnaire was administered through face-to-face interviews with all respondents and key informants. Then FDGs were held in the two regions selected. Quantitative prescriptive data analysis used ranking in SPSS. Qualitative was analysed using thematic content analysis using ATLAS.ti version 8.

The production challenges listed by respondents in the face-to-face interviews were carried into the second phase of data collection where groups ranked their importance. The most critical constraint was ranked number 1. The group then supplied the attributes of this critical constraint as well as the possible solution for its mitigation. These solutions formed opportunities for intervention in the sector. The rankings were subjected to Friedman's rank and Wilcoxon Signed ranks test to determine the most significant of all constraints collectively.

The Wilcoxon signed ranks test helped in establishing variation of responses between the two regions while Friedman's test established variation of responses between the FDGs. The details of discussions were analysed using ATLAS.ti through themes and codes for networks on identified critical constraints and opportunities for sector development. Only significant constraints were analysed from transcribed data and the opportunities thereof. The results,

therefore, presents the basic constraint as well as the defined attributes expanding the elements of the basic constraint.

Objective C: To assess financial literacy levels of smallholder farmers.

The purpose was to assess the financial capacity of smallholder farmers to transact through different financial tools. Quantitative data were collected using structured questionnaires from fifty-seven purposively selected smallholder baby vegetable growers. An adapted questionnaire developed by OECD (2016) and the tool by Fessler *et al.* (2019) was used to gauge respondents' financial knowledge, behaviour, and attitude from the local smallholder farmer perspective. The smallholder farmers' production was classified into two, irrigation scheme and private production. Irrigation schemes further categorised into clustered, semi-dependent producers. These supplied harvest to through the NAMBoard which provided extension, input credit scheme as well as transportation service to the growers. A census of all current producers was identified for through liaison with the buyer.

Data collection used structured questionnaires that were administered through face-to-face interviews and was collected based on the respondents' financial knowledge, financial behaviour, and financial attitudes using a Likert scale. Likert scale showing the following description: 5 = *strongly agree*, 4 = *agree*, 3 = *not sure*, 2 = *disagree*, and 1 = *strongly disagree*. A series of Likert-type questions were combined to describe respondents' financial knowledge, financial behaviour, and financial attitude. The results of the Cronbach Alpha coefficient for questionnaire reliability were 62%. Means and standard deviations were used to discuss these traits.

The FI represented the use of financial products in the following five use categories: money transfers receive payments, investments and savings, risk management as well as financing operations. Fifty-eight responses were analysed using frequencies, *t*-test, and logit regression.

Fessler *et al.* (2019) concluded that financial knowledge, behaviour, and attitude were complimentary; meaning, summing up the scores may be misleading on financial literacy. Therefore, the means and standard deviations of these components were compared using a one-sample *t*-test against the set benchmarks. Financial knowledge had nine questions on numeracy: budget allocation, inflation, integrated rate, and risk diversification. These were rated correct (1) or incorrect (0) for a total score of 9, which represented satisfactory financial

knowledge. A benchmark for adequate knowledge was set at 7 and the results of the group were compared.

Financial behaviour was assessed through thirteen Likert-scale questions on a scale of 1 to 5. The possible maximum score was sixty-five for acceptable financial behaviour and the lowest score of 13 for poor financial behaviour. A benchmark of fifty was set for satisfactory behaviour and the group mean was compared. On the same scale, the financial attitude had a maximum of fifteen for best financial attitude and the lowest was 3 representing bad financial attitude. Thirteen was the benchmark set for desirable financial attitude in a farm enterprise manager.

The relative proportions of each component were established for a maximum financial literacy score of 9 where each component carried a maximum score of 3. A benchmark of seven was set as a satisfactory level of financial literacy and the group was means-tested with a one-sample *t*-test (Gupta & Madan, 2016).

Logit regression analysis established the determinant effect of these components on financial literacy using their relative proportions as established for this group, refer equation 24.

$$Y = a + \beta X_1 + \beta X_2 + \beta X_3 + v \quad \dots \text{equation (24)}$$

Were,

Y = financial literacy,

X_1 = financial awareness,

X_2 = Financial Behaviour,

X_3 = financial attitude.

v = error term

Results of the omnibus test of model coefficients are significant at X_2 (4, $n=57$) 32.755, $p<0.01$). The model's overall practice capacity is 83%. Furthermore, OLS regression was used to determine the effect of financial literacy on-farm performance (AE), refer to Equation 25.

$$Y_i = \sigma + \beta_i X_i + v \quad \dots \text{equation (25)}$$

Where; Y_i is the dependent variables, $\sigma = \text{constant}$, β_i is the coefficient of the independency variables, X_i is the independent variables, $v =$ is the error term. The X_i included: payment (1 = MM account); experience in production; affiliated (1 = yes); off-farm income; age of producer; gender (1 = female); bank account ownership (1 = yes); have investment (1 = yes); ownership of insurance (1 = yes); and farmer's financial literacy level (categorical). The goodness of fit for the model in explaining farm allocative efficiency is 45% and there is a significant difference in variances of the estimated coefficients, $F = 3.13$ ($p = 0.004$).

3.7 Ethical Considerations

Akaranga & Makau (2016) noted that a researcher should always ensure that the design of the research project to be undertaken conforms to the rights and security of the target respondents. Upon approval of the research by the School of Agriculture at UNIVEN, the research was registered with the Directorate of Research. This registration enabled the application for ethical clearance with the Ethical Committee which ensured that the tools and approach is aligned to the rights of growers and their environment.

A letter of approval was thereafter sought with the Ministry of Agriculture through the NAMBoard before the commencement of the data collection process. The study targeted only the smallholder baby vegetable growers selling through the latter, and data was collected during the 2018/2019 growing season. The approval letter enabled community entry where the major stakeholders within the baby vegetable sector were visited to introduce the research. These included the NAMBoard development and Extension department, Ministry of Agriculture (Horticulture department), the chairpersons of the two smallholder irrigation schemes and the related traditional authorizes. Community entry fostered mobilizing interest towards the anticipated results of the research.

NAMBoard provided the list of active growers supplying baby vegetables into the pack-house, and the extension officers helped with locating them. Extension officers were allocated by operational zones within the Manzini and Hhohho regions. The growers were either members of smallholder irrigation schemes or private growers. The irrigation scheme committee members assisted with calling group meetings whereas private growers were called directly by the researcher using the details given by the NAMBoard.

The data collection process was in two phases and the growers participated in both. The first phase used face-to-face interviews and the second phase used focused mini-group discussions. Before the interviews for completing the structured questionnaire, the rights of respondents were explained to them. Consent for taking part in the research was sought from respondents and was expressed through the signing of the consent letters. At various stages of the process of data collection, reminders on the rights were made to ensure the respondents' full consent. Respondent rights regarded their rights to anonymity, confidentiality, and privacy during the research as well as the right to withdraw if one no longer felt comfortable with continued participation. Also, the consent of the respondents was sought for recording verbatim and pictures taken for use in the research report, a significant aspect in the qualitative data collection process. Throughout this process, the research team ensured that risk to research participants was avoided, using convenient and safe venues with minimal travel time.

3.8 Validity and Reliability of the study

A sequential integrated mixed-method research design was used to enable triangulation of results sourced from the different study objectives of the study. The variation and similarities of these results were augmented with literature to conclude. The instruments used in the two phases of data collection were adapted from their meanings and tools as given in the literature. For content validity, two experts were used to ensure that questions were neither ambiguous nor confusing but clear on the information sought as well as coherence (Maree & Pieterse, 2007). Proper community entry channels were used, and this enabled trust during interviews and FGDs between the study subjects and the research team. A pilot survey was conducted using a section of the Hhohho region growers who were no longer farming to evaluate the usability of the instruments. A review of the results enabled amendment of the study instruments. Friedman's test was used on quantitative data to enable the use of data that recorded significant variation between the groups. This enabled capturing the consistency of results under differing production environments (Saunders *et al.*, 2010). Moreover, the results presented were statistically significant for the hypothesis being evaluated. The quantitative data analysis used models that were validated by adopted statistical models. Also presented are only the statistically significant variables for each objective.

3.9 Outcomes/ Outputs

The smallholder baby vegetable production sector is a government-driven sector growing highly perishable agricultural products. The industry provided an opportunity to study the interdependency of enterprise efficiencies, risk exposure, and constraints in smallholder farm enterprise management. The level of financial integration through financial literacy and the FI of the growers were determined. The effect of these two mechanisms on the smallholder farm efficiency was established for the group.

The results of the study provided a basis for the sector risk management strategy that will capture the heterogeneity in smallholder farms operations. A business canvas for Smallholder Baby Vegetable Production in Eswatini was established, which provides a guide for sector development. Further, a synthesis of the results enabled the development of a proposed framework for smallholder grower integrations in high-value production. This framework guides strategy development where the target is to build the capacity of high-value product development through smallholder production.

The academic environment would draw from the results of this study insight into smallholder horticulture production for high-value export production and smallholder markets supplies. Literature on smallholder production efficiencies, risk exposure and probabilities, levels of financial inclusion and literacy on-farm efficiency will provide a base for future studies. The applied methodologies would also provide a guide into their adoption and use. Methodologies on the sequential mixed-methods approach, data collection process guides as well as the triangulation process for results synthesis.

3.10 Potential Impact

The results obtained from this study informed the synthesis of a proposed framework for sustainable smallholder farm enterprises through high-value crop production. This framework guides the interventions needed to enable the growth and integration of smallholder baby vegetable producers. The results were established in farming systems analysis, assessment risk exposure, and constraints attributable to the sector as well as FL and FI levels of farmers. The proposed framework, therefore, seeks to improve high-value crop production through farm efficiencies, risk management, and financial flows management in smallholder baby vegetable

enterprises. The goal merged production efficiencies, risk management, and financial integration as drivers of farm growth in the smallholder baby vegetable production curve.

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CHAPTER 4 CHARACTERISTICS OF THE BABY VEGETABLE GROWERS

4.1 Introduction

This chapter presents the results of the production characteristics of the farming system, representing the resource management framework to achieve economic and sustain agricultural production to meet diverse requirement of the farm household while preserving the resource base and maintaining high environmental quality.. This is part of the aim on characterising of the production efficiencies. Established variations give insight into observed performance variations in the sector towards reaching the sustainable development goals on no poverty and zero hunger in Eswatini. The purpose was to determine who is producing? How are they producing? and how is each clustered performance towards the enterprise return's objective?

4.2 Methodology

This was a descriptive study whose details of method are given in Chapter 3 under objective one.

4.3 Results

The results present the enterprise analysis which is analysed on irrigation system and crop species.

4.3.1 Farm Characteristics

About 58% of the respondents were from Hhohho and 42% from Manzini regions. Gender distribution indicated that a total of 33% were male, while majority (67%) were female. The average age of the respondents was 48 years, and only 17% qualifying to be classified as youth. Apparently, 49% of respondents had secondary school education, 19% having no formal education, 18% having tertiary education, and 14% having primary education. On average each household had seven members who could work in the farm, but 60% of the respondents had more than seven members in their households.

There were 74% of the respondents that were full-time growers, and 26% were part-time growers. Part-time growers earned off-farm income and utilised hired labour. Off-farm income also enabled private investments into irrigation infrastructure. Contrary, off-farm income exacerbated consumption than farm investment in smallholder agriculture, Ethiopia (Beyene, 2008). Producers was classified into two groups, irrigation scheme growers (60%) and private

Table 4. 1 Characteristics of Respondents.

Measure	Hhohho (%)	Manzini (%)	Overall
Respondents	58	42	100
age number of years			
maximum	75	71	76
minimum	26 ^F	29 ^M	26
average	49,3	47,2	48,4
Gender	54	46	100
Female	42	25	67
Male	12	21	33
Years of Experience			
0 to 4	28,1	29,8	57,9
5 to 9	15,8	10,5	26,3
10 to 14	15,8	0,0	15,8
Household size			
0 to 5	17,6	7,1	24,7
6 to 10	31,6	31,6	63,2
11 to 15	5,3	3,5	8,8
Affiliation			
Farmers Union	7	19,3	26,3
Irrigation Scheme	47,4	26,3	73,7

** superscript F= males and M=male

growers (40%). Irrigation scheme growers had two categories: clustered production (27%) and semi-dependent production (33%). Irrigation schemes were established with the assistance from the government through the provision of infrastructure and irrigation system development. Lastly, private growers had private drip irrigation systems, sourcing water from drilled boreholes. These growers used privately sourced capital to establish irrigation infrastructure on their private farms.

Both clustered and semi-dependent growers form labour groups that collectively carried out the farm activities such as planting and weeding. These used hired labour only for harvesting activities, which was done daily from the date of maturity for an extended six-week period. There were 75% growers who used a combination of both hired and family labour while only 8% used exclusively hired labour. The average individual land size under baby vegetable production was 1.4 ha. The clustered growers had 1ha of land per member, and this limited the use of additional land within the set irrigation system. All growers had winter irrigation, though, the level of water in the rivers affected this practice during winter in furrow irrigation.

On average, two crops were grown per season. There were 52% of respondents who produced all year. Predominantly, the production of baby vegetables in Eswatini is done on the traditional customary land tenure system, where land taxes and trade value are not enforced.

Figure 4.1 below shows the training of farmers in baby vegetable production, and the results indicate that 80% of the farmers have been trained to-date. Of the six training programmes essential for crop production, more than 70% of the growers have been trained in quality control (75%) and baby vegetable husbandry (70%), respectively. Only 57% of the grower were trained specifically on baby vegetable production. All farmers recorded receiving at least one extension visit per week provided by the buyer. A total of 87.7% of the baby vegetable growers accessed these services and most farmers (49.1%) were visited by the officers once a week and only 3.5% were visited three or four times a week.

There were six most prevalent baby vegetable species grown in both regions and these are: baby green beans, baby marrow, yellow petty pens, baby gem, snap peas, green petty pens, and red cabbage. The baby marrow was dominantly grown (58%) in the Hhohho region while green beans were the dominant crop grown (61%) in the Manzini region.

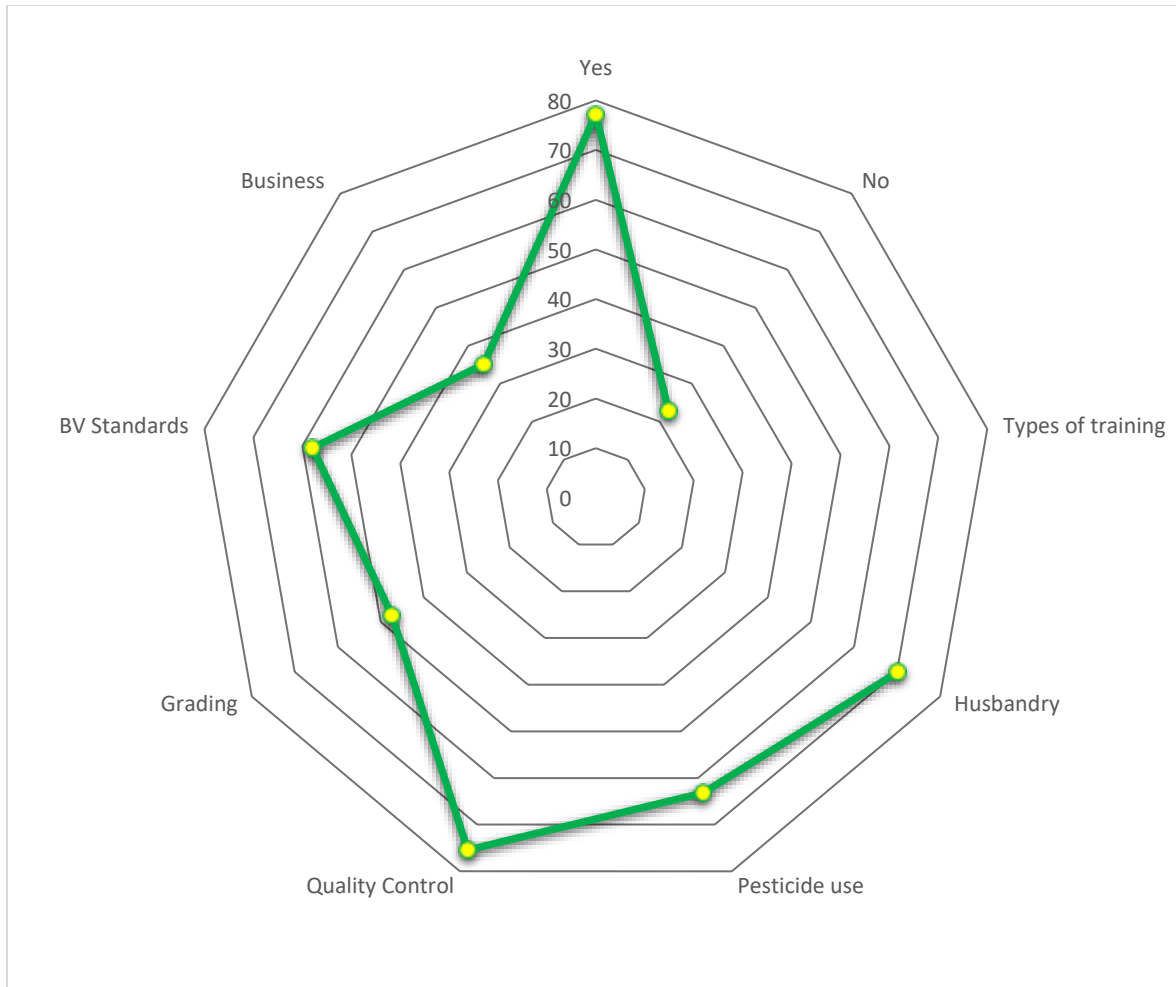


Figure 4. 1: Respondent's training in baby vegetable Production as Percentage

(Source: own survey)

4.3.2 Enterprise Budget Analysis

This section presents the enterprise budget analysis of the baby vegetable enterprise. First the profitability and then an investment appraisal into the irrigations systems used by the growers are presented. A year had an average of two growing seasons and six different baby vegetable species were reported produced in the farms. The gross margins per crop species were determined in the smallholder baby vegetable enterprises. Multiple comparisons using ANOVA presented a significant variation ($p < 0.05$) exists in gross income per hectare among irrigation scheme growers where semi-dependent had higher returns. The variation could be attributable to the differences in farm management systems used by growers, namely, irrigation and labour management.

Profitability of Enterprises by Crop Species

Accordingly, Table 4.2 shows that baby marrows realised on average 2371kg (2.4tonnes) per hectare. Green beans were second, yielding at 2192kg (2.2tonnes) per hectare. The variable costs varied with the crop species. Green beans had the largest costs at E10.61 per kilogram, which were attributable to labour costs. Yellow petty pens had the largest seed costs (E5 778/ha) and baby marrows had the lowest cost per unit kilogram at E9/kg while baby gems had E16/kg.

Table 4. 2: Gross Margin Analysis for Baby Vegetables

Parameter on 1ha	Baby Green Beans	Baby marrow	Baby gem	Yellow petty	Snap Peas	Green petty
Harvest (kg)	2,192.40	2,371.13	1,344.72	1,798.24	1,152.51	1,807.71
Value of sales (E)	32,886.06	35,566.88	20,170.87	26,973.59	25,767.65	35,595.65
Total variable costs	15,391.00	13,857.00	13,752.00	13,905.00	8,892.00	12,877.00
Total Enterprise Costs(E)	23,261.20	21,420.40	21,294.40	21,478.00	15,462.40	20,244.40
TC E/unit	10.61	9.03	15.84	11.94	13.42	11.20
Gross margin (E)	17,495.06	21,709.88	6,418.87	13,068.59	16,875.65	22,718.65
Gross margin (%)	53.2	61.0	31.8	48.4	65.5	63.8
GM E/unit	8.0	9.2	4.8	7.3	14.6	12.6
Variable cost / kg	7.0	5.8	10.2	7.7	7.7	7.1
Net return	9,624.86	14,146.48	(1,123.53)	5,495.59	10,305.25	15,351.25
Net return/unit kg	4.4	6.0	(0.8)	3.1	8.9	8.5
Profit rate (%)	41.0	66.0	(5)	26.0	67.0	76.0
Break-even yield (kg)	986.26	826.06	1,580.11	1,042.05	901.95	935.35
Break-even price (E)	10.6	9.0	15.8	11.9	13.4	11.2
Operating expense ratio	0.71	0.60	1.06	0.80	0.60	0.57
Operating Margin %	0.29	0.40	(0.06)	0.20	0.40	0.43

Green petty pens had the highest value of harvest at E35,595.65 per hectare while baby gem had E20 000 per hectare, which was the lowest of all species grown by respondents. Snap peas had the highest gross margin percentage at 66% while green petty pens had 64%, owing to the difference in yield quantities and production costs per unit. Again, snap peas had the largest net return per kilogram at E9/kg. Baby gem squash had the lowest return recorded with a loss of 80cents per kilogram. The operations ratio shows that 60% of revenue was used to cover production costs, with the highest rate in green petty pens (43%), baby marrows (40%) and snap peas (40%). In these enterprises, only 40% of revenue generated by the enterprises were retained for production. Furthermore, green petty pens had the highest profit rate at 76%. This rate presents the ability to cover the cost of capital for investments into the green petty pens enterprise.

Snap peas had the lowest yield (902kg) for break-even while baby gem had the highest (1500kg) breakeven yield. The results show less marketable value for baby gem squash than the other crop species. The average break-even price for the group was E12 per kg against the E15/kg market price. Here, the results show a 20% price margin. Baby marrows had the highest break-even price margin at 40% while snap peas were lowest at 11% breakeven price margin. An improvement in cost management could enable a high breakeven price margin in the enterprises. Baby gem squash and yellow petty pans presented the highest operating costs while baby marrows and green petty pens had the highest operating margins (40%).

4.3.3 Irrigation Investment Appraisal for Baby Vegetable Enterprises

Table 4.3 presents the investment appraisal of the three irrigation systems used for baby vegetable production. The estimation of capital investment into furrow irrigation proved impossible since the infrastructure was old. Therefore, only maintenance costs were used in the enterprise budget costs. The three irrigation systems considered are drip, sprinkler, and dragline irrigation. Average baby vegetable enterprise characteristics were used to determine the appraisal evaluation for each irrigation system. The dragline had the shortest payback period and the highest internal rate of return. However, it has a shorter lifespan such that its replacement falls due after three years of use as the drip irrigation system. Sprinkler irrigation had the highest gross return and longest life span, allowing for an additional four years

Table 4. 3: Irrigation Appraisal under Baby Vegetable Enterprise

Irrigation System	Cost	Lifespan	IRR %	GR %	NPV (E)	Net cash flow (E)	Payback period (2 seasons/year)
Drip	96,852	3	9	17	35,512	16,564	6
Sprinkler	45,345	8	56	466	40,380	229,902	4
Dragline	20,960	3	108	286	100,721	59,328	2

*Using 2018 price estimation and 5% annual inflation

of use after repayment of the investment. Amongst private farms, 12% of the growers used drip and 8% utilised sprinkler irrigation system (8%). A total of 74% of dragline users were from the semi-dependent schemes.

4.4 Discussion

Baby vegetable production was on traditional tenure and was by adults (48years) who had secondary education, and mostly were females (67%). There was only 17% youth involvement in production. This is explained by the fact that the youth does not own land, they only access land through inheritance under the traditional tenure system, such that their participation is through providing family labour. Also, the youth focus on higher studies and lack understanding of the sectors' ability for economic gains (Uttej *et al.*, 2019, Geza *et al.*, 2021). However, studies (Geza *et al.*, 2021) show that youth engagement is positively associated with improved used of information technology in agriculture. Therefore, promoting youth engagement in baby vegetable production can improve farm output and marketed share, thereby improving farmers' economic benefit and stability within the baby vegetable value chain. The average household size was 6 people, and these provided family labour. However, high harvesting labour demands engaged hired labour. Production was mostly (60%) under irrigation schemes of furrow and sprinkler irrigation. Contrary to the report by Pittock *et al.* (2017) that government develop irrigation schemes to promote low value staple crops, these schemes were solely for high-value vegetable production. Private growers were part-time growers with off-farm employment which enabled private investments into irrigation infrastructure.

The clustered scheme members produced baby vegetables on one piece of land, which was divided into plots that were allocated to each grower. The semi-dependent scheme members were producing individually on household landholdings using the scheme's infrastructure for irrigation. The individual members here draw water from the reservoirs to their fields, and they used a mix of sprinkler and furrow irrigation systems.

High-value all year-round crop production provides a reliable and consistent way of living for farm labour (Janvary *et al.*, 2018). An average of two crop cycles were harvested per growing season and the average land size was 1.4ha. As observed in Zimbabwe, Moyo *et al.* (2017) communal irrigation scheme had high levels of land utilization with plot size of 1ha. Training and frequent extension visits to farms improved farmers' production capacity which enabled improvements in farm output. Extension service was visible in these areas with 49% of respondents visited once a week for advice on production and harvest management. Mariyono (2017) observed that smallholder training had a positive and significantly effect on

the commercialization of vegetable production in Indonesia while Athipanyakul & Pak-Uthai (2012) concluded that knowledge enable the adoption of good agricultural practices. Furthermore, Ashahjar *et al.* (2018) reported that mass media, extension contact, education and social participation have significant negative correlation with farmers training needs. Growers indicated that extension officers were also available on mobile networks to assist.

Average harvest was 2.2tonnes (2200kg) of baby vegetables per hectare and major variables were recorded from labour and seed inputs. There was one market channel for these growers. The buyer provided input credit for seeds, agrochemicals, and fertiliser to the growers. The basis of value chain development and inclusiveness is resources provision to the marginalised for a profitable production (Bellemark & Lim, 2018). Production cycles and supply was scheduled through the supply contracts help with the buyer. Accordingly, Gramzow *et al.* (2018) concluded that contract farming fosters formal quality mechanisms and inclusion of smallholder in high value markets. This value chain coordination, therefore, was heavily reliant on the buyer who also provided for products assemble, transportation and warehousing and processing. In line with Ajwang (2018), contracts in the vegetable industry provided smallholders with production services to help control against product quality variation for the market.

Six varieties were recorded crop and the highest yield value was observed on green petty pens with 76% profit margin. Results indicate that crop choices can enable profitability in farm enterprises. High yield levels were recorded in baby marrows however; a lower (66%) profit margin was recorded. Farmers' inability to supply consistent product quality and quantity to the market is a barrier to sustainable improvements on farm returns (Nichlin *et al.*, 2006; Arinloye *et al.* 2015). Scheme members using sprinkler irrigation had the highest net returns given its lifespan; contrary to highest returns on drip irrigation system recorded in smallholder vegetable production in Botswana (Imtiyaz *et al.*, 2000). A variation that could be attributable to dependency on hired labour of part-time growers.

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CHAPTER 5 ANALYSIS OF THE TECHNICAL AND ALLOCATIVE EFFICIENCY LEVELS OF THE BABY VEGETABLE IRRIGATION FARMERS IN ESWATINI

5.1 Introduction

This chapter presents results on the technical, allocative, and economic efficiency levels of the baby vegetable production systems in Eswatini. The government drives the production system through the provision of extension, water resource development, and market coordination. Smallholder agricultural development is an initiative aligned to the NEPAD-CAADP 2014-2024 agricultural development framework (NEPAD, 2014). This framework advocates for capacity building for high resource efficiency through enabling policies and investments. CAADP also targets inclusive growth and transformation by 2025, closing yield gaps through high productivity. Efficiency studies have been adopted to understand yield variations, benefits of input expenditure as well as evaluate the capacity of producers to benefit from supplying quality products to the market. Efficiency analysis, therefore, enables the identification of factors causing yields gaps and varying production performance of farming enterprises. The purpose is to inform the achievement of the decent farm work and economic growth in the sector. Therefore, the results present a need for capacity in the management of the production process for desirable outcomes.

5.2 Methodology

Reference is made to Chapter 3 for details on the methods and model specification for the efficiency analysis. The results present a comparison of TE, AE and EE results from the SFA analysis.

5.3 Results

An overview of the descriptive results of respondents' characteristics and an overview of the farm inputs used as variables in the model Table 5.1. A majority (58%) of respondents were from the Hhohho region of Eswatini. Female respondents were the majority (67%) in both regions and most respondents were member to irrigation schemes. Also, the 58% of the farmers had less than four years' experience on the project.

Manzini region had no farmers with an excess of nine years, reflecting farmers who left the sector or late adoption in the Region. Most respondents had up to secondary education. 15% had primary education while 18% had no formal education. The largest household size was fifteen people and the majority had (63.2%) had up to ten household members.

Table 5. 1: Production Characteristics of the Enterprises

Record	Mean
Output (Kg)	3220,35
Land size	1,4
Total Seed cost	4 810,30
Total Labour cost	4 418,60
Family labour	3 161,40
Hired Labour	1 628,60
Total Fertilizer cost	1 450,30
Lime cost	997,60
Basal cost	865,30
Topdressing	769,30
FoliarV12 cost	148,10
total tractor	667,20
agrochemicals cost	546,80

NB: Costs presented in Swazi currency Emalangenzi where (E1) = 1ZAR = 0.0708 USD ex September 2018

5.3.1 Technical Efficiency

The respondents' average technical efficiency (TE) was 0.497 and less than one. Table 5.2 presents the technical efficiencies for the inputs involved in baby vegetable production.

Table 5.2: Final Maximum Likelihood Estimates - TE

Variable	Estimate	Std. Error	z value	Pr (> z)
Constant	4,9232	0,859	5,732	9,917e-09 ***
Seed rate (kg)	0,1979	0,158	1,253	0,210308
total fertilizer (kg)	0,491	0,124	3,947	7,924e-05 ***
Total labor (man-hours)	0,0631	0,083	0,756	0,449427
Land size (ha)	-0,0184	0,174	-0,105	0,916062
Tractor (hours)	0,3049	0,19	1,609	0,10767
Agrochemicals (litres)	-0,0007	0,059	-0,013	0,989928
sigma Square	1,4079	0,458	3,075	0,002105 **
Gamma	0,8553	0,135	6,346	2,210e-10 ***
log likelihood value			-66,72***	
Mean efficiency			0,497	
Range			0,08 to 0,84	

Significant codes: '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

The minimum TE observed was 0.08 and the maximum 0.84. There exists a potential for respondents to improve the farm TE by 16% to reach the desirable 100%. However, the average respondent could reduce the quantity of inputs used in production by 40.8% to attain the maximum technical efficiency level (84%) recorded for the group. While the respondents observing the least TE level (8%) can benefit from 90.5% reduction in quantity of inputs used if they could operate at the maximum TE (84%) recorded for the group.

Results show only the elasticity of fertilizer was significant ($P < 0.001$) and positive. This indicates that for a 10 unit increase in the use of fertilizer, there is going to be a 4.9% increase in the quantity of output in the baby vegetable enterprises. Though not significant, the partial output elasticities of land-size and agrochemicals were negative while labour, tractor hours and seed rate were positively related to TE. This shows that any additional unit into the quantities of land and agrochemicals used will cause the output to decline.

The scale efficiency of the enterprise was given by the summation of the elasticities. The scale production efficiency is 1.04 reflecting that for purchased baby vegetable farm inputs and labour, suggesting that increasing all inputs will result in a 4% increase above proportionate increase in output. The farm inputs were represented by the sum of elasticities of fertilizer, seed, tractor hours and agrochemicals. Concerning farm inputs, returns will be equated to expenditure on inputs. However, the farm inputs were more productive (0.99) than labour (0.06) and land (0.02).

The gamma $\gamma = 0.855$ ($p < 0.001$) and significantly different from zero, therefore the $H_0: \gamma = 0$ is rejected and H_a accepted. There are technical inefficiency effects on the use of inputs in the baby vegetable production process. That is, the production input quantity model is essential for explaining the production inefficiencies observed in the baby vegetable enterprises. The sigma square (δ_2) is also significant ($p < 0.01$), indicating the correctness of the specified distribution of the composite error term ($v-u$).

5.3.2 Allocative Efficiency

The results of the allocative efficiencies of the baby vegetable growers are presented below in Table 5.3 The average allocative efficiency for the sample is about 53 per cent, with a minimum efficiency value of nine per cent and a maximum efficiency value of 84 per cent. This implies that, based on the cost frontier model, on average, the smallholder baby vegetable farmers can obtain 53 per cent of potential income from a given mix of production inputs costs (seeds, fertilizer, agrochemicals, labour, tractor). Therefore, a potential exists for these farmers to improve farm returns by 47% through improving production efficiencies to a maximum (100%).

Table 5.3: Final maximum likelihood estimates - AE

Item	Estimate	Std. Error	z value	Pr (> z)
Constant	4.70	1.75	2.68	0.007 **
ln (Total Seed cost)	0.24	0.098	2.42	0.015 *
ln (Total Fertilizer cost)	0.47	0.145	3.24	0.001 **
ln (total tractor cost)	0.16	0.170	0.95	0.34 6
ln (Total Labour cost)	0.11	0.146	0.75	0.45
ln (Agrochemicals cost)	-0.22	0.143	-1.5	0.13
Sigma Square	1.27	0.143	-1.5	0.000 ***
Gamma	0.77	0.146	-1.5	1.254e-07 ***
Log likelihood value:	-67.66 ***			
Mean efficiency	0.53			
Range	0.09 to 0.84			

Significant codes: '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

However, only two elasticities for seeds and fertilizer were significant, ($p < 0.01$; $p < 0.5$ respectively). Seed cost coefficient at 0.237 ($p < 0.001$) and positive indication that an optimized seed allocation will enable the smallholder baby vegetable farmers to attain the same level of output. There exists the potential for the farmers to reduce seed cost by 76.3%, while an optimized fertilizer allocation will reduce their cost of production by 50% (0.469, $p < 0.001$) for the same level of output. Noted is the negative relationship with agrochemicals, though statistically insignificant, the present use of this input is negatively affecting the output levels released by respondents. The elasticity for tractor and labour costs are positive but not statistically significant. All input elasticities were less than one indicating overutilization of input in the production which increases the cost of production relative to the scale.

The economic scale efficiency of baby vegetable production is given by the summation of the elasticities of the production input costs (Hong & Yabe, 2015; Tavva *et al.*, 2017; Vashandass *et al.*, 2018). The 0.79 scale economic efficiency is less than 1 reflecting decreasing returns to scale. This implies that, concerning the farm inputs and labour costs, the benefit in income realized will be less proportionate to an increase in the amount of the additional input costs. The purchased production input costs were presented as the sum of the cost of seeds, fertilizer, agrochemicals and tractor (Vashandass *et al.*, 2018). The 0.679 scale efficiency recorded for bought production inputs reflects that purchased production input costs is more productive than labour (0.109) on these producers.

The gamma $\gamma = 0.77$ ($p < 0.001$) for allocative efficiency function, showing that it is significantly different from zero therefore the cost-oriented efficiency is essential in explaining the variability of the recorded outputs. That is the allocative inefficiency effects are significant in determining the level of cost variability recorded in the baby vegetable producing farms in the Kingdom of Eswatini. Therefore, the null hypothesis ($\delta = 0$) is rejected, and H_a accepted. There are allocative inefficiency effects in the production costs of baby vegetable production in Eswatini.

5.3.3 Economic Efficiency

Results of economic efficiency as product of technical and allocative efficiency, present that average economic efficiency is 29% for the respondent. The lowest EE is 10% and the highest EE is 67%. The least economic efficient grower would have to reduce production costs by 85.1% to realize the highest EE (67%) level in the group, while the average grower would reduce production costs by 57%. Refer Table 5.4

Table 5.4 Distributional Efficiencies of Respondents

Efficiency Level	Technical Efficiency %	Allocative efficiency %	Economic Efficiency %
less than 10	4	1.8	16
10 to 20	5	5.3	16
20 to 30	5	5.3	14
30 to 40	7	7.0	28
40 to 50	16	15.8	14
50 to 60	21	21.1	7
60 to 70	32	33.3	5
70 to 80	5	5.3	-
80 to 90	5	5.3	-
90 to 100	-	-	-
100,00	-	100.0	-
Mean Efficiency	0,497	0.53	0.29
Efficiency range	0.08 – 0.84	0.091 - 0.84	0.01 – 0.67

5.3.4 Distribution of Efficiency Levels among Respondents

Table 5.4 shows that there were 37% of respondents with technical efficiency (TE) below 50% level and 63% recorded above 50% TE level. Only 4% was below 10% TE level while none recorded TE above 85% level. There were 53% of the respondents who recorded between 50% - 70% TE level.

Distribution of allocative efficiency (AE) shows that 35% below 50% level while 65% of the respondents recorded above 50% AE level. There were 12% respondent with AE below 10% level. Economic efficiency (EE) had only 12% of respondents above 50% EE level while 88% recorded below 50% EE level. None recorded above 70% EE level while on TE and AE, none recorded above 80%.

Results also presented that semi-independent scheme growers had the highest AE (84%) while private growers had the highest TE (81%) and EE (67%). Private growers used drip irrigation and the majority delivered their produce to market. These results indicate the advantages of farm settings and irrigation systems used.

5.3.5 Factors Influencing Economic Efficiency

The results in Table 5.5 show that only household size is statistically significant at the $p < 0.1$ level of significance. Household size attributed to labour cost savings as family labour was free enabling economic returns. Thereby, it impacted the overall farm efficiency. Household size, education, training on BV and number of crops grown have a positive influence on economic efficiency while gender, land allocated to baby vegetable farming, experience, access to extension services have a negative influence on economic efficiency. A change in gender from female to male will negatively affect EE. The same for an increase in land size. The respondents' experience and access to extension services had a negative effect on EE.

Table 5.5: Factors of Economic Efficiency

Variables	Estimate	Std. Error	z-value	Pr (> z)
(Intercept)	0.07	0.28	0.256	0.798
Age of farmer (years)	0.001	0.003	0.317	0.751
Household size (number)	0.021	0.012	1.787	0.074*
Gender of farmer (1=female)	-0.013	0.074	-0.169	0.865
Land size used (hectares)	-0.012	0.019	-0.635	0.526
Years of formal education (years)	0.01	0.007	0.906	0.365
Experience in baby vegetable production (years)	-0.01	0.007	-1.142	0.254
Trained in baby vegetable production (1=yes)	0.077	0.078	0.991	0.322
Access to extension services (1=yes)	-0.14	0.094	-1.505	0.132
Number of Crop Species Grown	0.051	0.031	1.631	0.103
Log(scale)	-1.68	0.113	-14.838	<2e-16***
Scale:	0.1863			

Gaussian distribution

Log-likelihood: 10.18 on 11 Degrees of freedom (Df)

Wald-statistic: 10.73 on 9 Df, p-value: 0.29484

Significance codes: 0*****0.001 **** 0.01 *** 0.05 ** 0.1 *

The log scale (-1.68) was negative and greater than zero which showed a good model fit for explaining economic efficiency in baby vegetable production enterprises. Adding the dummy variables on gender, access to extension and training on baby vegetables had no contribution to the economic efficiency model specification. The Wald test is employed for testing the effect of introducing dummy variables to model categorical predictors in a regression model (Bruin, 2011).

5.4 Discussion

The respondents' average technical efficiency (TE) was 0.497 and less than one. Contrary to the 75% average TE recorded for tomato enterprises in Ethiopia (Weldegiorgis *et al.*, 2018) and 89% for red onion respondents in Sri Lanka (Atapattu & Rupasena, 2016). While on vegetable, respondents in Nepal and Cameroon recorded 62% and 67% TE respectively (Akamin *et al.*, 2017, Shrestha *et al.*, 2016). Also, tea respondents were recorded in Vietnam while tilapia respondents observed 97% in China (Hong & Yabe, 2015, Zongli *et al.*, 2017). However, results are very close to 44.7%, recorded for 1ha of cocoa in Malaysia (Fadzim *et al.*, 2017).

Only the elasticity of fertilizer was significant in driving technical efficiency (4.9, $P < 0.001$) and positive. Optimised use of fertiliser can enable high yields in the sector. Fertilizer output elasticity is also significant for tea (0.17), wheat and cocoa (Fadzim *et al.*, 2017, Hong & Yabe, 2015, Tavva *et al.*, 2017). Though not significant, the partial output elasticities of land size and agrochemicals were negative while labour, tractor hours and seed rate were positively related to TE. As Figueiredo Filho *et al.* (2013) stated that the magnitude of the differences become an important statistic measure when the sample size is equal to the population. Since a census is used, there is no room for the expected value of the population parameter (Figueiredo Filho *et al.*, 2013). Agrochemicals and labour had negative elasticity to tea yield in Vietnam (Hong & Yabe, 2015).

The scale efficiency is 1.04 reflecting that concerning capital and labour, suggesting that increasing all inputs will result in a 4% increase above proportionate increase in output. The capital was more productive (0.99) than labour (0.06) and land (0.02). Jara-Rojas *et al.* (2018) reported a scale efficiency was 0.922 in raspberry in Chile hence the baby vegetable enterprises are on increasing returns while raspberry was on decreasing returns to scale.

Allocative efficiency of 53.5% presents a potential exists for these farmers to improve farm returns by 47% through improving production efficiencies to a maximum (100%). This is in line with the results from Shresta *et al.* (2015) where the mean allocative efficiency of small-scale vegetable farmers in Nepal was 0.5 while Mokgalabone (2015) recorded 0.39 allocative efficiency on smallholders in Tzaneen, South Africa. The gamma $\gamma = 0.769$ ($p < 0.001$) for allocative efficiency function, therefore, the null hypothesis ($\delta = 0$) is rejected which says there are no allocative inefficiency effects in the production of baby vegetables in Eswatini. The respondents could obtain 53 per cent of potential income from a given mix of production inputs costs (seeds, fertilizer, agrochemicals, labour, tractor). A potential exists for these respondents to improve farm returns by 47% by using cost-effective input levels maximum (100%). Significant factors driving allocative inefficiencies were seed and fertilizer costs. Cost savings on these through optimises and cost-effective input levels can render respondents' high returns on the enterprises. This was attributed to the need to reseed a reapply fertilizer after poor germination, given the inconsistent quality inputs.

Lower allocative efficiency levels in clustered and independent farms show the potential for savings on actual input cost and improvement in the volume of harvest sold. The underutilization of fertilizer observed in TE linked to its significant expenditure in AE suggests inadequate farming skills. Overexpenditure of fertilizer was recorded the same as in rice production in Nigeria where fertilizer was to be reduced by 98.2% (Ajoma *et al.*, 2016). While seed rate significantly affected yield levels in red onions and wheat in Vietnam and Afghanistan, respectively (Atapattu & Rupasena, 2016; Tavva *et al.*, 2017).

Respondents observed product losses to colour, overgrown, bruised and wilted produce on grading. Postharvest losses due to inconsistent seed quality and handling are in line with Gautam *et al.* (2017) in Nepal. Authors observed that postharvest losses in tomatoes amounted to a quarter of the total harvest weight of the produce. These were losses along the value chain before reaching the consumers while about a fifth of these was bought at lower than market prices due to poor quality. Product value losses in the grading of strawberries were attributable to colour, freshness, texture and taste (Mahat & Chaudhari, 2018). Kankainen *et al.* (2016) established that producing quality traits such as product texture and skin colour significantly affect profitability.

In an interview on the 16th May 2019, Horticulture expert 1 stated that "*baby vegetables grow massively at an hourly rate, therefore, to harvest them at required sizes, farmers use more labour in this period. Farmers need to replace gaps of seedlings lost to poor germination, cutworm and dumping off. Losses are also driven by poor harvest to post-harvest handling before factory grading. Such that the harvest falls short of the actual seed*

rate applied on the scale, while fertilizer and chemical application are done according to scale. Therefore, postharvest handling of product needs to be regarded as a key element of efficiency when optimal gains are to be realized.”

The 0.79 scales allocative economic efficiency is less than 1 reflecting decreasing returns to scale. This implies that, with respect to the capital and labour, the benefit in output realized will be less proportionate to an increase in the amount of the additional inputs. This is similar to results recorded for tea production in Vietnam (Hong & Yabe, 2015). Returns to scale were 0.3 implying far less change in output given an increase in the scale of smallholder tea production.

Semi-independent scheme growers recorded the highest AE (84%) while independent growers had the highest TE (81%) and EE (67%). Independent growers used drip irrigation; the majority delivered their produce to market as well as privately invested into farm infrastructure. However, low technical efficiency in independent farms shows a skill gap in optimizing farm input levels.

5.5 Conclusion

The study used stochastic frontier analysis to determine the technical allocative and economic efficiency in baby vegetable production. Logit regression to establish factors of economic efficiency. The null hypothesis was rejected and the alternative accepted that there were inefficiencies in baby vegetable producing enterprises. Independent growers used drip irrigation and the majority delivered their produce to market. These results indicate the advantages of drip irrigation and private investment into farm enterprise development.

Fertilizer and seed costs were driven by high allocative inefficiencies while optimal use of fertilizer can improve technical efficiency. Household size enables economic efficiency. Seed and fertilizer costs were driven by the need to reapply on crop failure, hence the quality of inputs are major divers of inefficiencies in the sector. Enterprises were on increasing returns to scale with the capital being more productive than labour. Results show a significant farming skills gap needed for optimal input use while managing costs for maximum benefits. Smallholder capacity building and appropriate extension services are recommended for enabling returns to the growers. Also, investment into better input quality for germination rate and colour consistency.

5.6 Recommendation

Recommendations on production efficiency are listed in Chapter 8.

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CHAPTER 6 RISK FACTOR ASSESSMENT IN THE SMALLHOLDER BABY VEGETABLE PRODUCTION IN ESWATINI

6.1. Introduction

Risk is the probability of occurrence of an event that has potential to influence the achievement of specific production goals, where in results deviate from intended outcomes. Agricultural risks embedded with uncertainty of situations that determine the cost of production, volume of harvest and value of sales (Cervantes-Godoy *et al.*, 2013). The smallholder farmers have a high risk of failure as economic players in high-value chains because they have limited access to information, productive assets, and less capacity to adjust to shocks (Orr *et al.*, 2018). It is argued that the Value Chain (VC) analysis should consider their complexity and the actors' risk management capacity, which is informed by the identified and predictable risks associated with each of them (Orr *et al.*, 2018). Lipton's theory on risk management alludes to risk identification and prediction to establish strategies for enabling positive outcomes (Lindahl, 1987). However, risk management is a continuous process, therefore, the capacity of smallholder farmers to make informed decisions begins with enlightenment on risk exposure and predictability. Capacity to plan production using informed decisions enables enterprise sustainability, which is required for the green growth objective as well as rural development. The objective of this study was to determine and characterize the smallholder baby vegetable enterprise risk factors and the risk function thereof. It sought to establish heterogeneity of growers on risk exposure and provide insights to risk factors towards the establishment of the risk management framework for the cold chain.

6.2. Materials and Methods

The methodology for this chapter is discussed in Chapter 3 where details are given in responding to the objective.

6.3. Results

6.3.1 Loading Risk Factors in the Smallholder Irrigation Production

Using the results of the Likert scale with a mean = 3, the most loading risk factors were identified for each grower group. The mean rank of the risk factors is presented in Table 6.1. Risk factors are the matters, problems, or objects that can influence the magnitude of change in the overall plan and the cost-effectiveness indicators provided for the activity

(Stepanuk, 2017). It represents the reasons, circumstances and conditions that create an adverse situation with negative results in these enterprises.

Results show the five most loading risk factors for the group, namely: untimely payments 3.61 (1.79), yield changes 3.54 (1.3), high input prices 3.4 (1.45), product collection 3.3 (1.49), and fluctuating product prices 3.18 (1.3), respectively. The least loading risk factor was product demand indicating an unsaturated product market. A strong agreement was recorded on product payment as a loading factor threatening the sector with a standard deviation of 1.79. Delayed payments affect the liquidity of farms which impacts the timing of production activity and inherently quantity of harvest yield. Hired labour constitutes 25% of labour costs in vegetable farms, thereby increasing the demand for liquidity.

Growers recorded that product losses rose two weeks into harvest, where the collection demand rises beyond the buyer's capacity. Respondents recorded that an alternative market could absorb the excess crop. Respondents alluded to the reduction in the value of sales than anticipated. Full grading information could harmonise sale projections between growers and the buyer. The irrigation schemes had no cold storage facilities and means for product delivery. Long-distance and load conditions contributed to the inevitably unguaranteed value of deliveries. Farms were located more than 80km from the buyer's warehouse, a portion of which was gravel roads.

The clustered growers were significantly prone to market risks. Unique to this group was product collection failure 4.2(0.8), labour unavailability 4.1(0.92), and a decrease in the product price 3.8(1.01).

Labour unavailability was inherent from harvest labour demands which engaged hired labour. A high wage rate in Hhohho was influenced by proximity to competing for commercial plantations, which paid higher than the going wage rate. It showed a hike of 75% the E 40 per day in agriculture. Labour availability in critical periods constrains sustainable vegetable production (Ali & Abedullah, 2002).

Table 6. 1: Risk Factor Loading on Enterprises

Risk variable	Clustered Production (n=15)		Semi-dependent production (n=19)		Private Production (n=23)		Total (n=57)		
	Mean rank	Std. Dev	Mean rank	Std. Dev	Mean rank	Std. Dev	Mean rank	Std. Dev	
Market Risks									
Product Payments	1.67	1.234	3.74	1.727	4.78	0.850	3.61	1.790	
High Input Price	2.40	1.056	3.63	1.257	3.87	1.546	3.40	1.450	
Produce Collection Failure	4.20	0.862	3.11	1.595	2.96	1.551	3.33	1.492	
Fluctuating Product Prices	3.47	1.407	3.58	0.902	2.65	1.369	3.18	1.297	
Drop in produce Price	3.80	1.014	3.26	1.195	1.35	0.714	2.63	1.447	
Wage changes	Rate	3.27	1.280	2.74	0.933	2.26	1.389	2.68	1.270
Product Demand		3.87	1.302	2.37	1.422	1.48	1.123	2.40	1.580
Production Risks									
Yield changes		2.60	1.242	3.79	0.976	3.96	1.296	3.54	1.297
Labour availability		4.13	0.915	3.11	1.524	1.87	1.325	2.88	1.582
Pest Diseases	and	2.33	0.900	2.89	1.329	2.13	1.517	2.44	1.337

6.3.2 Group Classification Using Risk Experiences.

The discriminant analysis was adopted to classify the respondents based on the mean ranks of risk factors. The purpose was to establish if any group dynamics need to be addressed by the policy in risk management interventions. An equality test of means of risk variables shows that Wilks' Lambda values above 0.5 and statistically significant for all variables formed the covariance matrix. No variable was equal to 1.

Referring to Table 6.2, the lowest yet most significant Lambda value was change in the product price. However, changes in wage rate and crop disease occurrence were insignificant factors. Equality of mean test presented market risks, presented in product price changes (0.43) and product payments (0.5) as the most significant risk factors to this group. These factors had Lambda value closest to zero, reflecting that they contributed most to the group's recorded variability. Drop-in price was attributable to the variation in product quality harvest when the value was lost to postharvest handling and asymmetry in the grading system.

Risk factors are subjective or objective activities that entail unwanted development in future events that negatively affect realizing enterprise goals (Galwe, 2017; Filina, 2008). The matrix shows significant risk factors for the functions while the coefficients present the variables' relative contribution in predicting the dependent variable. The structural matrix in

Table 6. 2: The Role of Predictors in Explaining Risk Variation

Risk variable	Wilks' Lambda	F	Sig.
Market Risks			
Fluctuating Product Prices	0.887	3.445	0.039*
Produce Collection Failure	0.876	3.839	0.028*
High Input Price	0.821	5.893	0.005*
Product Demand	0.629	15.920	0.000*
Product Payments	0.507	26.302	0.000*
Drop in Produce Price	0.437	34.716	0.000*
Production Risks			
Yield Changes	0.804	6.571	0.003*
Labour Availability	0.657	14.069	0.000*

Table 6.3 shows significant risk factors that can be used to compare across production clusters, refer to equations 18 and 19. The classification using loading risk factors shows that loading risk factors significantly defined the farmer groups.

The probabilities of risk in each group are, therefore, represented by the coefficient functions below.

$$Z_1 = 0.672 FPP - 0.833 PP + 0.002 PD + 0.059 LA - 0.340 WR \quad \dots \text{equation 18}$$

$$Z_2 = 0.106 YC + 0.343 PDS - 0.114 IPP - 0.328 PCF + 0.295 Py \quad \dots \text{Equation 19}$$

The probability of experiencing risks in each production group is presented in Table 6.3. Large values indicate the high predictive power of the risk factor.

Results show that fluctuating product prices (-0.66) were a high loading risk factor and negatively influenced future outcomes in clustered grower enterprises, here referred to as Z_1 . Positive and high loading was fluctuating product prices (0.57) in the clustered irrigation scheme. The large coefficient for fluctuating product prices (-0.83) and product payment (0.67) show that clustered growers were prone to market risks, delays in product payments were observed frequently. Contrary, yields changes (0.4), disease and pesticides (0.41) positively and significantly influenced future outcomes in private grower enterprises (Z_2). Negatively influencing outcomes in the private group was product collection failure. Yield changes, pests and diseases were production risks.

Growers were classified into clustered and semi-dependent growers by improving the classification error from 17.5% to 100%. Results present that 87% of clustered production were correctly classified, while 13% were incorrectly classified. In the semi-dependent production, 58% were correctly classified, while 42% were not. Results show that the two types of irrigation systems are exposed to different risk factors. This could be attributable to regional location, weather differences and group formation.

The results show that product price (0.66) was a high loading risk factor, and it negatively influenced future outcomes in clustered grower enterprises, hence referred to as Z_1 . Product payments (0.57) were a high loading risk and positively influenced outcomes in this group. Contrary to the independent grower enterprises (Z_2), variation was positive and significant in yields changes (0.4) and disease and pesticides (0.41).

Table 6. 3 : The Discriminating Risk Functions

Variables	Structural Matrix		Coefficients	
	Function 1	Function 2	Function 1	Function 2
Market risk				
Fluctuating produce price (FPD)	-0.661*	0.447	-0.833	0.720
Product Payments (PP)	0.571*	0.443	0.672	0.342
Product Demand (PD)	-0.449*	-0.289	0.002	-0.609
Wage Rate (WR)	-0.202*	-0.060	-0.340	-0.313
Input Price prices (IPP)	0.250	0.358*	-0.023	-0.114
Product collection failure (PCF)	-0.197	-0.315*	0.146	-0.328
Product price (Py)	-0.185	0.306*	0.270	0.295
Production Risks				
Labour Availability (LA)	-0.433*	-0.024	0.059	0.097
Yield changes (YC)	0.259	0.409*	0.342	0.106
Pest and diseases (PDs)	-0.066	0.401*	-0.280	0.343

* Largest absolute correlation between each variable and any discriminant function. values >0.3.

Negatively influencing outcomes in the independent group were product payments and product collection. Both the product price and payments were categories under market risks; therefore, clustered growers were prone to market risks. Yield changes, pests and diseases were categorised as production risks. Risk categories indicate that semi-independent growers were significantly affected by production risks. The growers were classified into clustered and semi-independent growers by improving the classification error from 17.5% to 100%. The results show that 87% clustered production was correctly classified, while 13% were incorrectly classified. In the semi-independent production, 58% were correctly classified, while 42% were not. Similarities in production systems did not represent homogeneity in risk exposure.

The study verified that the variance-covariance matrices were identical from one risk variable to another, refer to Table 6.4.

A null hypothesis was tested, which says.

H_0 : equal variance-covariance matrices for intra classes, $P > 0.05$.

H_a : covariance matrix of intra classes is not equal, $P < 0.05$.

The null hypothesis was rejected, and H_a accepted, presenting that the covariance matrix of intra-classes is not equal. The condition of unequal variance-covariance matrices, therefore, was verified. The Box's M test allows results to be concluded best if Fisher is significant at $P = 0.000$; therefore, discriminant analysis for this study is validated. Presenting that there is variation in the risk factors experienced by the different respondents in the survey. Figure 6.1 presents the classification plot for the group, reflecting an overlap of risk factors of the semi-dependent group across the clustered and private growers.

Table 6. 4 : The Overall Testing of the Linear Discriminant Analysis Model

Box's M	259.2
F approx. (P-value)	1.686 (0.000) ***
Eigenvalue	2.839
% Of variation	89.1
Canonical correlation	0.855
Wilk's Lambda	0.2 (0.000) ***
Chi-square, p-value	80.40 (0.000) ***

*** = sig. at 1%

6.4 Discussion

There were 76% full-time growers, and 24% were part-time with off-farm income. Accordingly, Kusunose (2020) observed that smallholder farmers' limitation to access to credit forces a dependency on off-farm income. Hence, the results reveal that baby vegetable growers heavily depend on off-farm income, which may not allow for adequate investment into the production and marketing processes. This, therefore, reduces farm output levels through limited investment and time allocated for production. Ali *et al.* (2008) reported that market and production risk factors were significant in vegetable production. Results also confirmed that production and marketing risks were significant in these baby vegetable enterprises. High input prices were attributable to the non-competitive supply of inputs. Input prices, credit constraint, farm size and unavailability of input of time are major factors of input supply in agriculture (Tilahun *et al.*, 2019) while access to quality input limited productivity in small-scale irrigation in Zimbabwe (Mdemu *et al.*, 2016; Moyo *et al.*, 2016). The average farm size was 1.4ha for this group.

Fluctuating product prices were attributable to grade value where multicoloured fruits and wilted harvest was under-graded and discarded. Accordingly, Elik *et al.* (2019) presented that maturity standard, field packaging and transportation drive losses in product quality in vegetables. Product collection failure contributed to lower product grade through limited farm investment into postharvest handling.

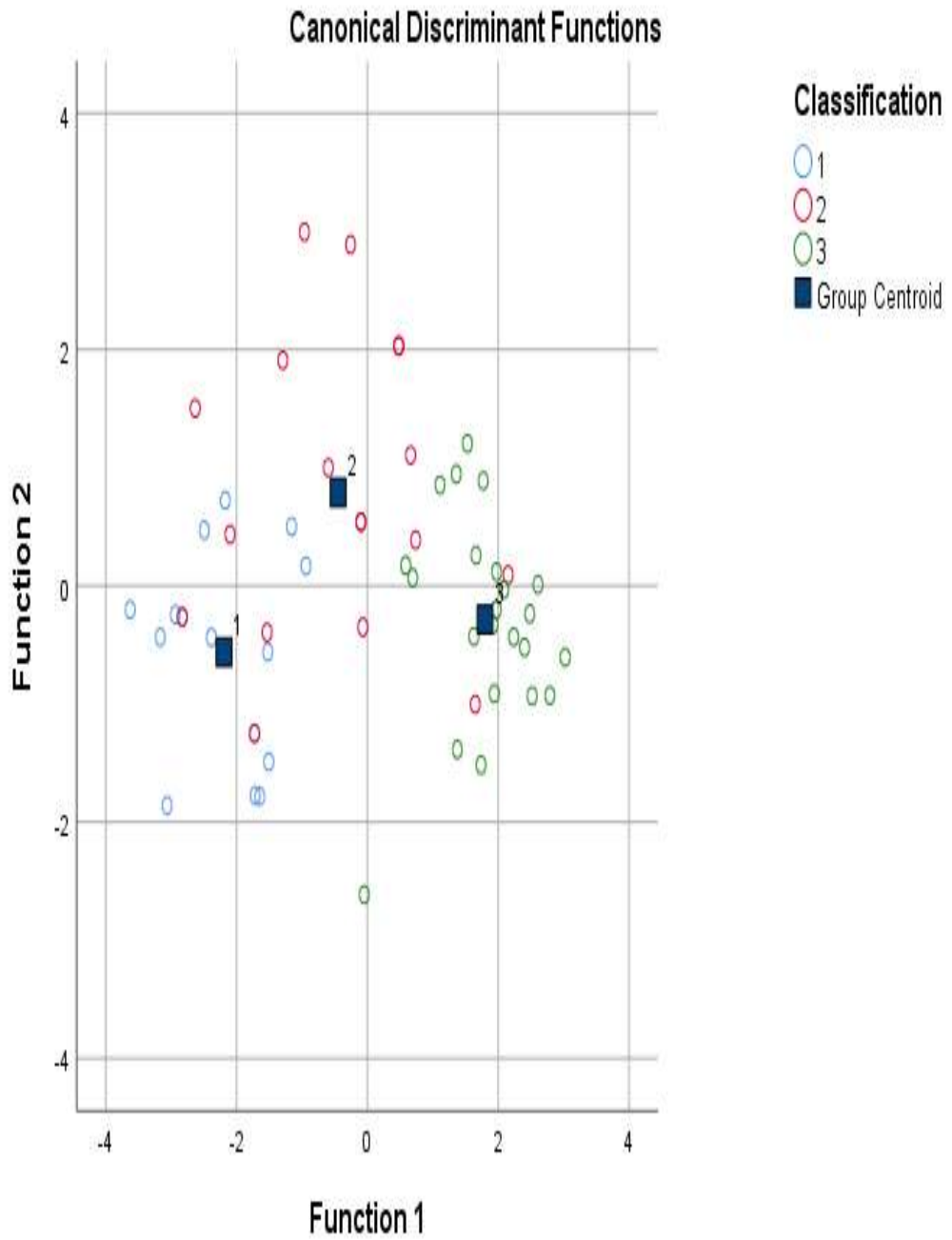


Figure 6. 1 Discriminant classification plot

Delays in product deliveries and methods of transportation are contributors to postharvest losses in vegetables (Nagaraj *et al.*, 2008; Elik *et al.*, 2019; Nagaraj *et al.*, 2008). Determinants of a method of transportation are distance to market, product perishability and harvest value (Elik *et al.*, 2019; Harris, 1988).

The irrigation schemes had no cold storage facilities and means for product delivery. Long-distance and load conditions contributed to the inevitably unguaranteed value of deliveries. Harvest quality of fragile and perishable vegetables depend on transport conditions (Oliveira & Batelha, 2021; Traya *et al.*, 2021). Labour unavailability was inherent from harvest labour demands which engaged hired labour. Also, a high wage rate in Hhohho was influenced by proximity to competing for commercial plantations, which paid higher than the going wage rate. It showed a hike of 75% of the E40 per day in agriculture. Labour availability in critical periods constrains sustainable vegetable production (Ali & Abedullah, 2002). Overgrown fruit sizes could not be sold. Smallholder farming lacks capital investment into production technologies like greenhouses in China (Reardon *et al.*, 2009, Wang *et al.*, 2009), these also assisted with weather protection. Accordingly, the cost of inputs limited financial resources and labour during peak periods are factors influencing yield variation (Elik *et al.*, 2019). Yield changes are presented through the inability to treat some pests that persist in the seasons as well as the effects of weather variation.

The high probability of fluctuating product prices and delayed payments in the clustered irrigation scheme could be a lack of bargaining power (Hu *et al.*, 2004). Delayed payments limit the financial resources of enterprises and the use of quality inputs (Elik *et al.*, 2019); Tilahun *et al.*, 2019). Yields changes, disease and pesticides positively and significantly influenced future outcomes in private grower enterprises. In agreement, Stringer *et al.* (2009) concluded that the production scale, distance to market, and producer contract details are the characteristics of risks in vegetable supply chains. Results present that regard for heterogeneity in smallholder interventions is paramount in enabling the attainment of the developmental goal. Furthermore, the influence of farm resource endowment on the significance of observed risk factors and the risk orientation of these groups should be established to guide the risk management framework .

6.5. Conclusion

The use of the discriminant analysis classification method is a validated method for classifying smallholder baby vegetable growers in Eswatini. This technique improved classification from 83% to 100% using the perceived risk factors recorded, therefore presenting factors of heterogeneity in these farms. The sector is significantly affected by

market risks. These were expressed through delayed product payments and high input prices. Non-compliance to sales terms in the contracts affected the cash flow of these enterprises. Delayed product payments influenced the liquidity of farms by affecting the capital investments and the timely access and use of quality inputs in production. The non-competitive supply of farm inputs contributed to high input prices. Product returns fluctuated through product quality lost after harvest lowering the value of ex-harvest. This presented asymmetry of grading information beyond farmgate.

6.7 Recommendation

Recommendations on baby vegetable risk factors are listed in Chapter 8.

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CHAPTER 6B CONSTRAINTS IN SMALLHOLDER BABY VEGETABLE PRODUCTION

6.1 Introduction

This chapter sought to establish the constraints of smallholder baby vegetable production in Eswatini. The identification of constraints enables the proper design of an intervention to improve the sector impact in economic development thereby enabling poverty reduction (SDG 1) and provision of decent incomes to growers (SDG 8).

6.2 Methodology

Detail of methodology for the chapter is given in Chapter 3.

6.3 Results

6.3.1 Significance of Constraints to Smallholder Baby Vegetable Enterprises

Respondents recorded nine constraints in the production of baby vegetables. These are financial flow, information flow, market and supply, production activities, quality inputs, credit, pests and diseases and weather changes. These individually perceived constraints were then ranked in the nine groups. Ranks were subjected to Friedman's rank. Table 6.5 shows a significant variation ($X_2 = 29$, $p = 0.000$) in the perceived constraints of baby vegetable production among the nine groups. Results also presented financial flow, information flow, market and supply, production activities and quality of inputs as the significant constraints with mean ranks above 4.5.

Table 6. 5 Ranking of Baby Vegetable Enterprise Constraints

Variable	Mean	Std. Deviation	Percentiles			Friedman Test: Mean Rank
			25th	50th (Median)	75th	
Financial Flow	7,44	0,527	7,00	7,00	8,00	6,50*
Information	7,33	0,707	7,00	7,00	8,00	6,22*
Market and Supply	6,78	1,202	5,50	7,00	8,00	5,17*
Production Activities	6,78	1,093	6,00	7,00	8,00	4,67*
Quality Inputs	6,67	1,000	6,00	7,00	7,50	4,50*
Credit	6,67	0,707	6,00	7,00	7,00	4,22
Pests and Diseases	5,67	1,323	5,00	6,00	7,00	2,72
Weather Changes	5,00	1,658	4,00	5,00	6,00	2,00
Chi-Square	29,170					
Asymp. Sig.	0,000					

* = significant with mean above 4.5

The Wilcoxon Signed ranks was used to determine the most significant of all constraints collectively in the two regions. The *post hoc* analysis results in Table 6.6 are in line with the median, which was 7 and 6.8 and insignificantly different ($z = 0.61$) for Hhohho and Manzini, respectively.

6.3.2 Thematic Analysis of Group Responses to significant Constraints

Two categories of results are presented: production-related constraints, and supply and market constraints. These categories resulted from the relationships attributable to inform the broader primary challenge to enterprises. Therefore, the networks on each of the themes is a nodes' relationship construct of issues underlying the practical problem here referred to as basic constraints. Declared constraints define the underlying problem's attributes; therefore, are symptoms represented as nodes of the network (Baker *et al.*, 2015).

The overall challenge defined by the nodes in the thematic network constitutes the significant constraint.

6.3.3 Production-Related Constraints

Figure 6.2 below presents the five production-related nodes constraining smallholder baby vegetable enterprises in Eswatini which include the following: limited access to finance, the inconsistency of input supplies, suboptimal operation environment, inadequate production planning, and high production costs. The limited access to finance to cushion farm liquidity presented a gap in cash flow management where cash inadequacy was recorded through high dependency on input credit and the lack of alternative finance for hired labour. Finance labour requirements were paramount, given that it cannot be accessible through the input credit scheme.

The respondents operated in remote, marginal areas and relied on microfinance initiatives like group saving and MM accounts, which were readily available. However, a limitation of these to fuel liquidity of farms was recorded. These loans were small and prioritised for household consumption. The respondents received the payment through MM accounts, a branchless initiative that enabled reaching the unbanked community. It facilitated cost-effective business-to-person and person-to-person cash transfer mechanisms. The inconsistency of farm input supply was attributable to the untimely availability of inputs needed for production. Unavailable inputs are recorded in the timeliness and unmet demand for organic agrochemicals in the sector.

Table 6. 6: Results of Wilcoxon Signed Ranks Test for Constraints

Variable	Percentiles (n=8)		
	25th	50th (Median)	75 th
Hhohho Groups	5,7	7,0	7,3
Manzini Groups	6,1	6,8	7,3

Measure	N	Mean Rank	Sum of Ranks
Negative Ranks	2 ^a	5,50	11,00
Positive Ranks	5 ^b	3,40	17,00
Ties	1 ^c		
Z		-,508 ^b	
Asymp. Sig. (2-tailed)		0,611	

Input range was limited by the implementation of the National Implementation Plan for the Management of Persistent Organic Pollutants of 2010 (SEA, 2010), which restricted the use of only a biodegradable range. Fewer alternatives of agrochemicals have been introduced, and this affected the rate of disease and pest control.

High production costs contributed to the inconsistency of input supply wherein respondents reflected on the labour intensiveness of production, input credit prices, and high-water pumping costs. Water pumping direct from the river follows the non-functional reservoirs in the Hhohho region. The poor farm infrastructure conditions recorded in lack of fencing against livestock along an old and poorly maintained irrigation infrastructure. One of the reservoirs was no longer functional because of siltation. that water seepages flood area upon irrigation

Suboptimal production conditions were declared using basic technology limiting crop protection against varied weather conditions. Baby vegetables thrive in cool weather conditions, and their delicate nature is easily threatened by extreme weather. The Ntfontjeni and Mlobane schemes have favourable climate conditions for all-year-round production. However, recent climate variability has posed prone snow, hailstorms, and heatwaves in these areas with reducing yields. Improvement in growers' adaptive capacity is essential through climate change adaptation strategies and technological advancement.

Furthermore, production plans were undermined by the inadequate availability of government tractors in winter. The respondents depend on government tractor supply centres where additional tractor drivers were employed for only the growing season. The respondents had access to buyer and government extension services. These assisted with training, field demonstrations, harvest monitoring and disease control. They also consulted with the local tractor pool for tractor requirements.

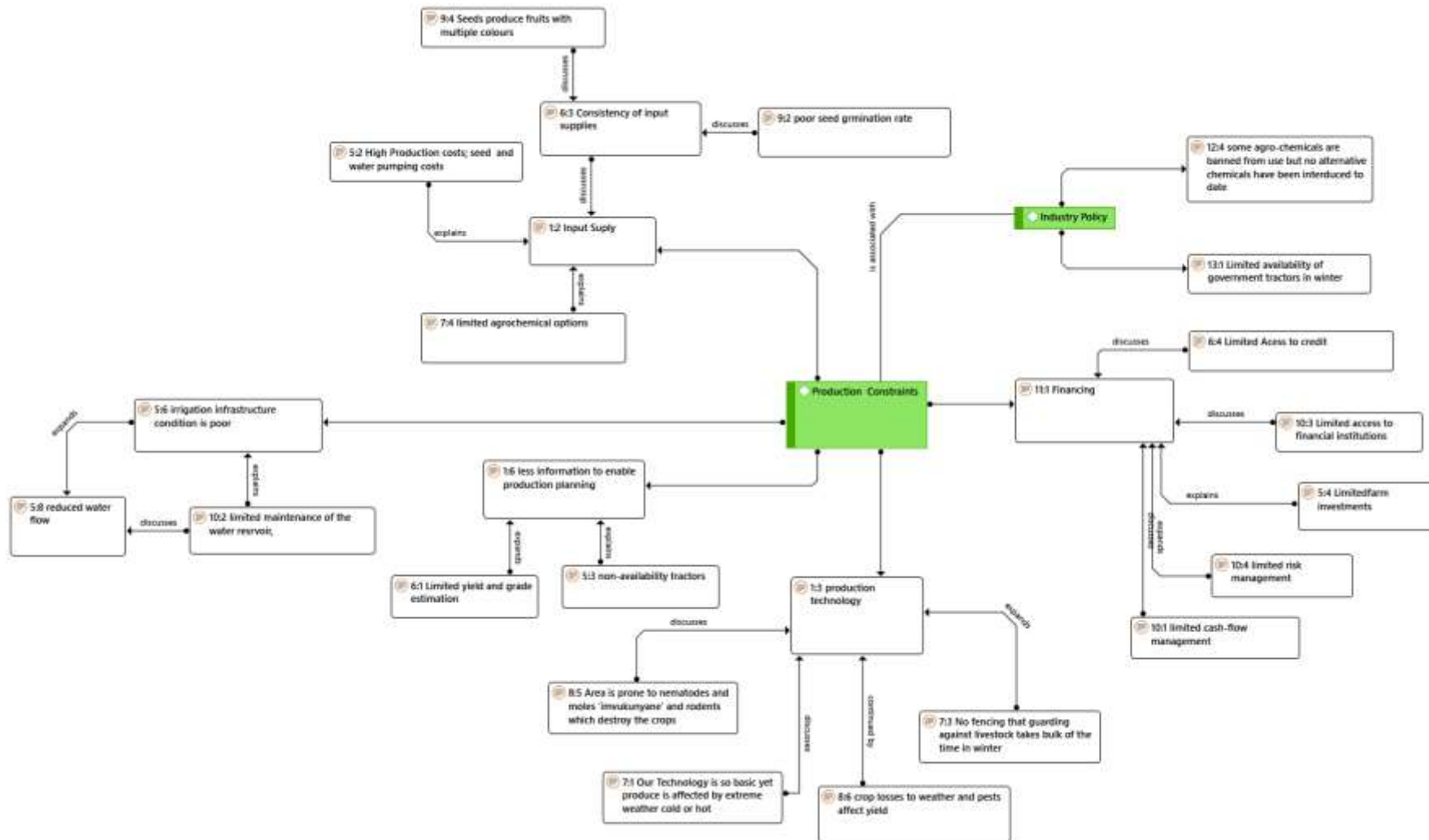


Figure 6. 2: production-related constraints

6.3.4 Market and Supply Related Constraints

The results shown in figure 6.3 present the following five declared marketing and supply constraints: inadequate information, period to receive payment, high product losses on grading and produce losses to weather variation. These results show that respondents had inadequate product delivery information since weighing and grading off-farm was done off-farm, and this limited stock accountability. As a result, delayed product payments were observed which contributed to the illiquidity of farms. Though input credit enabled the purchase of inputs, meeting hired labour demands for harvesting remained a challenge inherent to cash flow.

Improper storage was recorded with concerns from use of non-refrigerated transport and the lag time to product deliveries to market. Observed was that 25% of the grower produce collected in the morning while 75% was collected in the late afternoon. Distance to pack-house influences the harvest-to-grading period in the group.

"Trucks come late in the afternoon to collect produce that was harvested over the two days interval and stored in our houses. The product might wilt and even change colour while on farm-storage, leading to a high volume of rejected produce by the market." Respondent 5 presented.

Freshness was also compromised during the storage of harvested produce in farms before collection as well as during transportation of harvest on the long-dead roads to the market. Moreover, there was limited use of basic technologies to preserve quality on-farm and during transportation.

6.4 Discussion

The smallholder participants in the baby vegetable VC were linked directly to the market with no intermediary buyers. The buyer provided them with extension services, training, input credit scheme and provided transportation of the produce upon harvest. Bamber *et al.* (2014) identified these four pillars of competitiveness for sustainable smallholder inclusion in high-value chains: smallholder links to markets, smallholder access to training, smallholder collaborative networks with value chain actors, and smallholder access to finance.

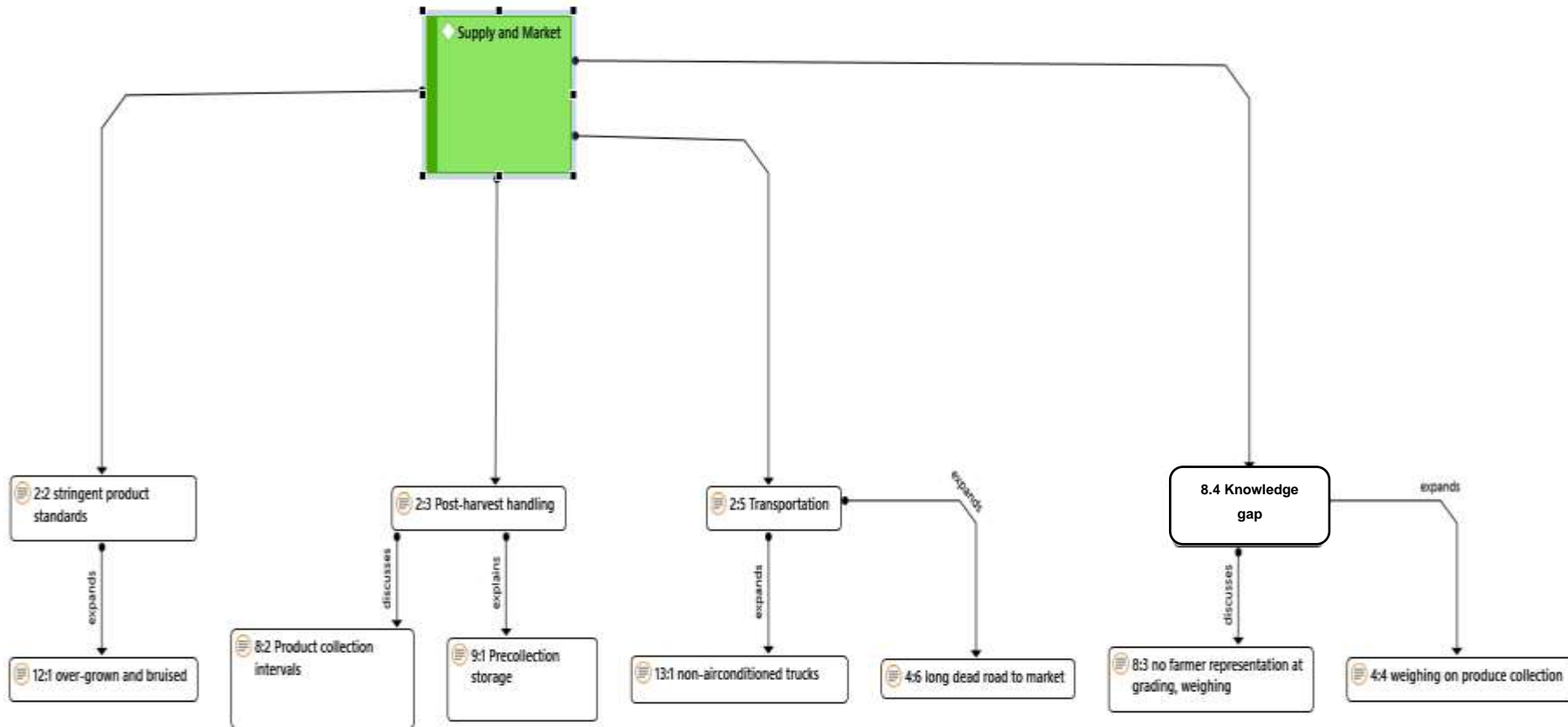


Figure 6. 3: Market and Supply Constraints

There were five production-related constraints were: limited access to finance, the inconsistency of input supplies, suboptimal operation environment, inadequate production planning, and high production costs. Financial access was limited by the production on traditional tenure system which has no exchange value and could not be used as collateral. Similarly, Tonui (2017) reported working capital, cash-flow management, and access to credit as significant factors in smallholder farming enterprises performance in Kenya. Lack of capital impedes increased production and productivity in vegetable enterprises (Kahsay *et al.*, 2016). In line with Peprah (2010), access to credit was highly correlated with the farmers' technical inefficiency through enabled used of improved technologies. MM accounts were used to pay producers who had limitations in enabling credit access and powered the illiquidity of smallholder farms. Accordingly, Btista & Vicente (2020) reported that low transfer charges in MM transfers decreased savings and investment into agriculture in Mozambique. Limited savings increased demand for credit use to cushion operational liquidity.

Swinnen (2018) observed that VC are embedded in transformation by linking farmers backwards through quality inputs and technology required for production. However, inconsistency of farm input supply affected production where multi-coloured fruits and low germinating seeds lowered value of harvest. As Wang (2008) recorded that good quality seeds increase average yields by up to 50%. High production costs were reported especially fertiliser, seeds, and labour costs. Fertiliser and seed cost significantly influenced vegetable enterprise productivity in Eswatini (Masuku & Xaba, 2013; Singh *et al.*, 2017). Ngare *et al.* (2015) concluded that high input price fluctuation is detrimental to smallholder enterprises as it poses the risk of losing all capital invested in production. Labour has a high proportion of variable costs for vegetable enterprises (Kshash, 2019). During the six-week harvest period, the labour demand intensified and used casual labour, which had limited skills and experience.

Baro-Ureta (2020) presented that improvement in irrigation infrastructure impacts smallholder farms' productivity when harnessed with complementary extension services. Inadequate infrastructure maintenance of irrigation and fencing was recorded in the group. Waterways were old and affected the flow of water to the whole farm that other plots were to be irrigated with the scheme. Similarly, in South Africa, Fanadzo *et al.* (2018) reported inadequate financial support to smallholder irrigation schemes that disregard land tenure insecurity effect of infrastructure maintenance. Ostrom (1994) and Sabatier (2007) concluded that rules in use are institutional factors influencing the performance of smallholder irrigation water management schemes in South Africa. In addition, Skaggs & Samani (2005) recorded that small farm in the USA were using inefficient irrigation practices,

had the inadequate on-farm infrastructure, and had less contributions towards improving the available irrigation systems.

Smallholder growers were had farming contracts that were renewable annually. However, participants recorded limited access to credit, risk management tools, and access to financial institutions despite the input credit scheme. As reported in India by Pandey *et al.* (2012), smallholder VC are characterised by a lack of accurate weighing systems and quality standards, slow processing times and long payment periods, including lack of knowledge on accurate market price and trends, which are critical for high profits for farmers.

In line with Romero & Wollni (2015), increasing transparency regarding market rejections of products and traceability of farm progress by the buyers is paramount to the sustainable supplier relationship. Furthermore, high rejections provoke farmers' mistrust in downward actors in the VC, while non-transparent dismissal of the product is not justified by the farmer who bears the crop losses (Romero & Wollni, 2015). Information access as early warning was too limited and responsiveness of growers. Accordingly, Manyatsi *et al.* (2010) confirmed that adaptive capacity of smallholder growers has not been fully explored in Eswatini, and the awareness of these changes is high among farmers though limited scientific explanation.

Limited capacity to preserve product freshness and standards compliance presented low sales values in baby vegetable enterprises. As Kshash (2019) concluded that the major constraint to perishable vegetable marketing is the high post-harvest losses. Accordingly, Baloyi (2010) concluded that preservation of product freshness is paramount to profitable vegetable supply, improper storage was also attributable to product collection using non-refrigerated transport and lapse time to product deliveries to market. Underhill *et al.* (2020) observed that major post-harvest losses in horticulture markets were due to transportation and market storage factors in Tonga. On-farm grading, therefore, helped transfer the responsibility of these product losses from farmers to owners of transport and market storage (Underhill, 2020). Contrary, respondents recorded that grading was at the pack-house post-storage after transportation. Moreover, there was limited use of basic technologies to preserve quality on-farm and during transportation. In line with Bamber & Fernandez-Stark (2011), participants recorded difficulty in preserving the quality of produce during pre-collection storage.

The smallholder farm productivity, quality, standards compliance, economies of scale and enforcement of contracts are listed as bottlenecks to their competitiveness in VC (Bamber & Fernandez-Stark, 2014). Also, enforcement of payment policy under the contract caused

cash-flow problems to the enterprises. These results confirmed the results by Jaffee *et al.* (2010) that there are eight major challenges associated with agricultural supply chains, namely: weather-related, natural disasters, biological and environmental risks, market-related, logistics and infrastructural, management and operational, public policy and institutional risks, as well as political risks. However, no political risk was recorded in this sector rather than the government being the only buyer of products. Moreover, Financial inclusion should target rural finance and credit access, with an emphasis on value to remittances as a source of income (OECD & FAO, 2014).

6.5 Conclusion

The results showed that there was significant variation in the mean ranks among the nine groups, however, there was an insignificant variation between the Hhohho and Manzini region participants. The clustered scheme production in the Hhohho region experienced problems of irrigation infrastructure maintenance while this was not evident in the Manzini region. This implies that undefined group ownership roles between users and government limit proper infrastructure maintenance.

Production was limited by traditional production technology which did not protect the crop from weather variations. An investment into weather-adapted production technologies could limit pre-harvest crop losses and improve the consistency of supplies. Also, side-selling was insignificant in the sector, however, post-harvest losses reduced farm returns. This implies that smallholder farm profits could be increased by improvements in post-harvest handling of products.

Both regions experienced inadequate financial and information flows, thereby limiting planning and liquidity. Sustainable smallholder VC inclusion can be improved with transparency in financial and information flow within the VC (Pagell & Shevchenko, 2014; Sjauw-Koen-Fa, 2018). This is closely linked to the need for governance and policy including investment into an intensive supplier information system that could enable information asymmetry and traceability of products.

6.6 Recommendation

Recommendation on constraints in baby vegetable production are listed in Chapter 8.

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CHAPTER 7 ASSESSING FINANCIAL LITERACY LEVELS OF SMALLHOLDER FARMERS

7.1 Introduction

In a drive for inclusive agricultural VCs in Eswatini, the Comprehensive Agricultural Sector Policy (CASP) of 2005 set up the Smallholder Market Led Programme (SLMP) collaborative intervention by government and non-government organisations. Its focus is on access to market information, enabling business plan development, supplying financial services, and provision of extension and advisory services (IFAD, 2015). The goals of the SMLP are in line with the practical efforts towards financial inclusion. In agriculture, financial inclusion tends to be biased towards promoting access to credit than the full basket of financial inclusion (FI) and financial literacy (FL). The holistic bundle of financial services is paramount for the practice of enterprise financial management function. The goal of this chapter, therefore, is to present both the FI and FL levels of the baby vegetable growers in Eswatini. Along these, is the explanation on how these levels influence farm management practice through its influence on AE.

7.2 Methodology

This is a descriptive and explanatory study on the smallholder baby vegetable growers found in the Manzini and Hhohho regions of Eswatini. Details of the method are presented in Chapter 3.

7.3 Results

Results are presented in four categories: the financial inclusion of growers, the financial literacy of growers, the factors of financial literacy in the group as well as the factors influencing allocative efficiency as a measure of financial performance of enterprises.

7.3.1 Financial Inclusion (FI)

The results are discussed under two categories: financial services for personal use and farm enterprise management. The ownership of financial services used by the respondents was categorised by gender and irrigation scheme membership. Table 7.1 shows that 79% of the respondents owned bank accounts, of which 44% were ordinary savings accounts. These were the part-time farmers with full-time off-farm employment and higher education qualification that enabled their demand for bank accounts (Cull *et al.*, 2014; Pasali, 2013). Full-time growers produced in remote rural areas and recorded irregular cash flows as they were had no off-farm income.

Table 7. 1: Ownership of Financial Products by Respondent

Mode	N	%	male %	Female %	Scheme Members %		Private %
					Clustered	Semi-dependent	
bank account	45	79	40	60	24	27	49
			$X^2 = 0.259 (0.6111)$		$X^2 = 7.0 (0.030)$		
Self-help groups	10	18	0	100	20	20	60
			$X^2 = 0.066 (0.041)$		$X^2 = 1.991 (0.370)$		
Cooperative	25	44	32	68	24	52	24
			$X^2 = 0.36 (0.85)$		$X^2 = 7.696 (0.21)$		
Investment	9	16	44	56	11	22	67
			$X^2 = 0.594 (0.44)$		$X^2 = 3.17 (0.21)$		
Insurance	14	26	40	60	27	20	53
			$X^2 = 0.41 (0.52)$		$X^2 = 1.94 (0.38)$		
Mobile Money	55	97	33	67	27	35	38
			$X^2 = 3.064 (0.216)$		$X^2 = 0.259 (0.611)$		

Limited liquidity and long distance to banking facilities negatively influenced with the demand for bank accounts in the two irrigation schemes. There were 74% full-time and 26% part-time growers in the group.

Of all the respondents, 97% had mobile money (MM) accounts and 18% were members of self-help saving groups. According to Brunie *et al.* (2017), savings groups activities were found to limit enterprise development in Mozambique, but only enabled household consumption and asset accumulation. Membership to cooperatives was recorded at 44% where, 15% had investments and 26% with insurance policies. MM accounts had multiple uses, utilised for receiving money, make purchases, make payments, and savings, refer to Table 7.2.

Ninety-three per cent of the respondents used MM accounts for receiving money. There were 75% who received payments and make purchases, while 70% used it to pay for standing orders. Only 28% from private members used the MM accounts for purchases. Another significant variation was recorded in the use of MM for payments within the scheme membership. Here, full-time growers used this service for transacting, given that it was the mode with which they were paid.

The group recorded heterogeneity, indicating that the MM accounts services could be escalated as a model for inclusive intervention for smallholder farmers. Similarly, microfinance instruments improved financial literacy and enterprise planning (Mahalder *et al.*, 2017). These MM accounts can potentially reduce the costs of sending money over distances due to high certainty of processes and are not prone to theft (Rouse & Verheaf, 2017). In agreement with Allen *et al.* (2016) MM accounts were preferred by respondents for the lower account costs, greater proximity and use of financial mediators, strong legal rights, and political stability in Ghana.

Financial Products Used for Farm Enterprise Transactions

The financial tools used by respondents for business were measured and four categories were considered; to make transfer money for payments, receive payments, and invest and insure. Various tools used by respondents are presented for each category. The results show that 49% used bank accounts to transfer payments, 38% used direct cash payments, and 12% used MM accounts. About 56% of the respondents used bank accounts, while 40% used MM accounts to receive payments. There were no facilities for branchless banking services, but the mobile network agents supported the use of MM accounts.

Table 7. 2: Mobile Money Account Use by Respondents

Purpose	N	%	male %	Female %	Scheme Members %		Private Growers %
					Clustered	Semi-dependent	
Receive payment	53	93	30	70	27	35	38
			$X^2 = 3.36 (0.067)$		$X^2 = 1.6 (0.45)$		
make Purchases	43	75	40	60	28	32	40
			$X^2 = 3.303 (0.082)$		$X^2 = 7.11 (0.029)$		
Transfer /deposit	41	72	25	75	19	32	49
			$X^2 = 0.204 (0.093)$		$X^2 = 4.191 (0.0410)$		
Save money	19	33	21	79	25	35	40
			$X^2 = 0.427 (0.808)$		$X^2 = 1.93 (0.164)$		

The irrigation scheme growers relied on a credit input scheme offered by the buyer. This is emphasised by Bovasria *et al.*, (2020) that enabling access to investment and insurance services, builds the agribusiness capacity to marginalised farmers. There were 64% respondents with no investments for business, while 92.3% had no insurance. Accordingly, Smith (2016) also showed that smallholder farmers are not attracted to commercially indexed insurance and rely on informal community-based methods, off-farm income, and the autonomy to change farm decisions.

Moreover, Pentala *et al.* (2016) observed that bank account ownership was not linked to savings, credit, or insurance. There was recorded 8% use of credit in the group. The collective operations in smallholder irrigation schemes failed to improve bank finance access (Simelane *et al.*, 2019). This is an indication of a lack of creditworthiness of respondents (Karlán *et al.*, 2010). Contrary, Fan & Zhang (2017) recorded that FI mitigates credit constraints in entrepreneurial formation.

7.3.2 Financial Literacy (FL)

Table 7.3 shows the average scores for the three financial literacy components. Financial knowledge, financial behaviour and financial attitude have significant influences on financial literacy (Tuffour & Amoako, 2020).

Table 7. 3: Mean scores of Financial Literacy Components

FL components	Minimum	Maximum	Mean	Std Dev
Financial knowledge	3	9	6.5	1.784084
Financial Behaviour	25	56	40.2	6.007253
Financial Attitudes	3	15	8.1	2.754468

Financial Knowledge

Financial knowledge enables financial literacy and financial skill development, which are essential for financial decision-making in business and personal final well-being (Lusardii, 2012, Scguchat *et al.*, 2009). Financial knowledge and financial literacy have a positive association (van Rooij *et al.*, 2009).

The results of the respondents from the nine-questions on financial knowledge are presented in Table 7.4.

Each question carried a score of 1 for correct responses, while 0 was for incorrect responses. A total score of 9 represents satisfactory financial knowledge and a total score of 1 shows poor financial knowledge. An assumed score of 7 was set as a benchmark for adequate financial knowledge. The respondents' average financial knowledge score is 6.5 (0.20). There were 51% of respondents who scored below the mean.

Hypothesis 1

H_{01} : the average financial knowledge score for the group is 7

H_{a1} : the average financial knowledge score for the group is less than 7

A one-sample *t*-test presents that $Pr(T < t) = 0.000 < 0.05$, therefore the H_0 is rejected, and H_a was accepted. The results present enough evidence that the mean score of respondents is significantly less than 7. Respondents with scores above the mean are considered to have the good financial knowledge and were 35% of the group. A significant difference was recorded in financial knowledge where most of the private growers were informed (60.9%, $p = 0.000$) than the irrigation scheme growers. A high education level is associated with high financial knowledge (Lusardi & Mitchell, 2007; Filpoak & Walle, 2015). Similarly, low financial knowledge is associated with a low level of education (Herd *et al.*, 2012, van Rooij *et al.*, 2009). There were 82% respondents with no tertiary education in this group, and 19% had no formal education at all. A significant difference (60.9%, $p = 0.000$) was recorded in financial knowledge, where most of the private growers recorded above the mean (>7). Accordingly, Gaurav *et al.* (2012) concluded that a basic understanding of financial products and financial numeracy is sufficient to grow a financial aptitude and debt literacy for informed financial decisions.

Table 7. 4: Financial Knowledge

Financial Knowledge	Mean	Std. Dev
Relative capital spending	6.12	0.47
Future value of money	7.56	0.37
Cost of credit	3.60	0.49
Interest benefit	5.49	0.49
Profit definition	8.55	0.23
When to borrow	6.75	0.43
Understanding inflation	7.92	0.33
Investing	5.35	0.48
Investing Strategy	6.66	0.44
Financial Knowledge Score	6.48	0.20

Financial Behaviour

Rai *et al.* (2019) concluded that financial behaviour was strongly associated with financial literacy. For this study, a benchmark of 50 was set for satisfactory behaviour (Gupta & Madan, 2016). The mean for the group was 40.2, refer to Table 7.5.

Table 7. 5: Financial Behaviour

Financial Behaviour	
I spend according to the business plan	
Carefully consider purchases	
Pay farm bills on time	
I keep a close watch on-farm expenditure	
Set farm plan expenditure and stick to it	
Each enterprise has a budget	
I recently borrowed to cover farm expenses	
I save a fixed amount every month	
I bought a financial investment in the last 12month	
I save only when a surplus is observed	
I gather information first before choosing suppliers	
I make shop around for available products before making a choice	
I take what my bankers advise on	
Financial Behaviour mean Score	40.2 (0.47)

Hypothesis 2

H₀₂: the average financial behaviour score for the group is 50

H_{a2}: the average financial behaviour score for the group is less than 50

The results of the one-sample t-test show that $Pr (T < t) = 0.000$, which is significant at 95% level of confidence. Therefore, the H₀ is rejected, and H_a is accepted. These results present enough evidence that the mean score of respondents is significantly less than 50. The respondents with scores above the mean are considered to have acceptable financial behaviour, and 96% of these had below mean fifty. Cole *et al.* (2009) established a considerable influence of financial literacy on financial behaviour among third world countries while Agarwalla *et al.* (2013) found a significant association between financial knowledge and financial behaviour.

Rai *et al.* (2019) concluded that financial behaviour was strongly associated with financial literacy. There were 35% of respondents who were trained in business planning through the workshop by the extension office. Business plans enabled loan acquisition and control of variable costs (Mishira *et al.* 2009). The respondents had no written business plans, unwritten production budgets, and only 8% used credit, which affected the practice of the financial function. Accordingly, one would not be saving-oriented without financial management training, therefore, would not present better financial behaviour (Mandell & Klein, 2009; Tuong & Doan, 2020). Financial planning through savings and investment can improve financial literacy (Tuong & Doan, 2020).

Financial Attitude

Ameliawatu & Setiyani (2018) found a positive influence of financial attitude on financial literacy as well as on financial behaviour which was inherent from the financial literacy effect. A benchmark was set at 13 for a desirable financial attitude (Gupta & Madan, 2016). The group had an average financial attitude score of 8.14 (0.94).

Hypothesis 3

H₀₃: the average financial attitude score for the group is 13

H_{a3}: the average financial attitude score for the group is less than 13

Hypothesis 3 was tested using a one-sample t-test and results show $Pr (T < t) = 0.000$, which is less than 0.05, therefore, presenting evidence to reject the null hypothesis and

accepting the alternative hypothesis. H_{a3} : *Mean* < 13, where 13 is the benchmark for a desirable financial attitude level.

These results show that 71% (mean < 5) of the respondents had an acquisitive financial attitude, and they reflect a free-spending attitude rather than saving (Paluri & Mehrra, 2016).

Shapiro & Wu (2011) concluded that lack of control over future outcomes decreases with the respondents' preference for saving, investment, and risk. Those with a conservative financial attitude were 21% (mean > 8), while 8% were more prone to saving for future use (mean ≥ 12). Accordingly, Rai *et al.* (2019) presented that financial information enables financial planning, which erodes a materialistic financial attitude.

Financial Literacy

Financial literacy is the level of financial knowledge and capacity to use the information to improve one's position (Lusardi & Mitchell. 2014; Huhman & McQuitty. 2009). It improves the farmer confidence in financial decisions and proper financial outcomes (Scheresberge, 2013).

The relative proportion of the three components of financial literacy was summed up for the value of financial literacy in the group, and its maximum score could be 9 and the lowest 3 on the scale down of the variables. The average financial literacy score of the respondents is 5.7 which is less than the score 7 set as the benchmark for this study following Gupta & Madan (2016).

Hypothesis 4

H_{04} : the average financial literacy score for the group is 7

H_{a4} : the average financial literacy score for the group is less than 7

The one-sample *t*-test shows that $Pr (T < t) = 0.0031 < 0.05$, therefore, presenting enough evidence to reject the null hypothesis and accept H_{a4} . The group mean (5) is significantly less than the benchmark (7). A lower than 7 score is considered poor financial literacy. The private growers were financially literate (65%, $p = 0.023$) and varied significantly from the irrigation scheme growers.

Financial literacy positively influenced financial inclusion of growers. There 92% MM account holders and 79% bank account holders in this group. Contrary, higher financial literacy was significantly influenced by bank account ownership that non-account holders as reported by Klapper *et al.* (2012) and Agarwalla *et al.* (2013). Financial inclusion levels present that user

demand for financial services depends on the intended purpose for use (Morawczynski *et al.*, 2010; Bovasria *et al.*, 2020). However, high MM accounts ownership present proximity and accessibility of this financial service to this group. No significant variation was recorded in gender, contrary to Devi (2016); Greimel-Fuhrman (2018) and Rai *et al.* (2019) who recorded high gender influence on financial literacy with women portraying high behaviour and attitude. Good financial behaviour is strongly linked with financial literacy.

7.3.3 Determinants of Financial Literacy

A Logit regression was adopted, where $Y=1$ represents financially literate ($score > 0.77$) and $Y=0$, Otherwise. The independent variables, knowledge, behaviour, and attitude were denoted as X_1 , X_2 , X_3 , respectively. The omnibus test model coefficients are significant at X_2 ($4, n=57$) $32.755, p<0.01$). The model's overall practice capacity is 83%, and a satisfactory financial behaviour significantly affected financial literacy. The odds ratio shows sixteen times more probability of a respondent with satisfactory financial behaviour to be financially literate than one with bad financial behaviour. The results demonstrated that those respondents with bad financial behaviour are less likely to be financially literate. The results are in line with Fessler *et al.* (2019), who recorded that low financial knowledge and attitude lead to poor financial behaviour.

Similarly, Rai *et al.* (2019) concluded that behaviour was strongly associated with financial literacy than financial knowledge. In addition, Anjali (2016) confirmed that financial literacy depends on an individual's financial needs and behaviour, and that financial knowledge and financial attitude were insignificantly influencing financial literacy. The results present that; indeed, financial knowledge alone would not foster financial practice in farms. Therefore, on-farm extension services should be extended to include financial knowledge through practice to enable sustainable adoption.

7.4 Financial Literacy And Financial Inclusion As Determinants Of Allocative Efficiency

The estimated FL and FI levels of growers were added in assessing determinants influencing AE. Farrell (1957) defined AE as the ability of growers to produce maximum output at the lowest cost combination possible. Using linear regression analysis, Table 7.6 presents that the means of financing ($p = 0.008$), growers experience ($p = 0.009$), age ($p = 0.012$), bank account ownership ($p = 0.023$) and having an investment ($p = 0.045$) have significant influence on the allocative inefficiency of smallholder baby vegetable enterprises.

Table 7.6: Determinants of Allocative Efficiency

Classification	Model Variables	Unstandardised Coefficients		t	Sig.
		B	Std. Error		
Farmer Characteristics	Constant	0.569	0.171	3.324	0.002
	Age of Producer (years)	0.005	0.002	2.632	0.012***
	Gender (1=female, 0 = otherwise)	-0.049	0.047	-1.042	0.304
Financial Inclusion	Experience in production (years)	-0.015	0.006	-2.749	0.009***
	Mode of Finance (1= Personal, 0 = otherwise)	-0.049	0.017	-2.807	0.008***
	Payment (1= MM)	-0.012	0.038	-0.330	0.743
	Affiliated (1=yes)	0.050	0.046	1.077	0.288
	Off-farm income (1= have, 0 = otherwise)	-0.009	0.052	-0.166	0.869
	Own a Bank account (1=yes)	-0.143	0.060	-2.369	0.023***
	Have an investment (1=yes)	0.155	0.075	2.070	0.045***
	Ownership of Insurance (1=yes)	-0.011	0.059	-0.189	0.851
Financial Literacy (FL)	Farmer's FL level	0.012	0.046	0.257	0.798

*** reflects significant variables at 5% level.

The model's goodness of fit was 45%, showing the proportion of the allocative inefficiency that is explained by the specified model. Significant difference in variances of the estimated coefficients were also observed, $F = 3.13$ ($p = 0.004$). The FI elements through tools used for financial transactions show that the financing tool significantly affected enterprise AE. The results show that using personal finance negatively influences AE. Changing the financing mode from personal finance to credit would increase the AE.

Accordingly, Bovasria *et al.* (2020) found that bank accounts holders do not use them for over a year, and only 7% used them to access bank finance in Mauritius. Similarly, Mishira *et al.* (2009) observed that business plans enabled loan acquisition and control of variable costs. The respondents had no written business and (95%) used MM accounts. Investment ownership was positive and significant, showing that cost-effective farm enterprises are incentivised to enable cost-savings in expenditure budgets.

The AE depended on financing mode, experience in production, the age of producer, bank account ownership and investment ownership. Financial literacy improved confidence in financial decision making and appropriate outcomes (Scheresberge, 2013). The respondents had an average of four-year farming experience, and results show that experience enables AE in these enterprises.

Owning a bank account was negatively related to AE and the mode of receiving payments, off-farm income, gender, and insurance ownership. The mode of payment facilitates ease of access to the money, transferability, and leakages away from profitable use. Similarly, Hilgert & Horgath (2002) records that increased financial knowledge, attitude and experience influence financial management behaviour. Off-farm income enables enterprises' liquidity, reducing the discipline for maximising the benefit of initial investments into enterprises. All respondents had no insurance.

The ownership of bank account and investment in FI significantly and positively influence the AE while FL level was not significant. This indicates that knowledge without practise is not effective in impacting enterprise performance. The respondents were financially aware; however, the financial attitude was poor. Private members were more informed and literate than scheme members. The respondents used direct deposits, cash for payments, bank and MM accounts for money transfers and receiving payments. Savings cooperatives were used for investment and saving purposes.

7.5 Conclusion

The FI of the respondents was enabled using MM services than was through banking services. For the MM services, however, money accounts were limited in use for savings and credit since any savings made were non-interest bearing and exacerbated on-farm consumption. Education on benefits of accrued investment into farm activities could help improve growers' expenditure decisions.

The savings groups enabled credit access to the unbanked respondents, but it was limited to short-term loans, which neglected the capital investment requirements of the enterprises. The legitimacy of MM transactions as a financial record would enable term credit from banks that embrace the long-term goals of these agribusinesses. Therefore, it is recommended that interoperability between bank and MM accounts be improved to enable financial inclusion through branchless banking.

The financial knowledge, behaviour and attitude of respondents are significantly lower than the benchmark. Most respondents did not practice business planning, cost tracking, and savings. The groups had poor financial literacy; it is recommended that farmer training in financial management tools such as cash flow management be expanded through extension and microfinance services.

Financial literacy is positively influenced by financial behaviour, through the practice of financial management tools in the private farm enterprise. The results showed that financial behaviour enabled demand for financial services that foster financial practice such as credit. Cultivating the adoption and use of financial management tools in small scale enterprises could expand into extension services that should enable the adoption of financial tools such as business plan preparation, farm planning, and cost tracking through written reports.

Allocative efficiency was significantly influenced by financing mode, experience in production, the age of producer, bank account ownership and ownership of an investment, not financial literacy. Extension services should enable the adoption of financial tools such as business plan preparation, farm planning, and cost tracking through written reports. Collaboration with financial service providers could also enable developing solutions tailored to this sector requirement, especially the credit and insurance products.

7.6 Recommendation

The recommendations on financial literacy and inclusion are listed in Chapter 8.

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CHAPTER 8 SYNTHESIS OF THE RESEARCH RESULTS

8.1 Background

The government of Eswatini is promoting the integration of smallholder farmers into high-value crop production as a viable strategy for inclusive green growth and, sustainable rural development. For that reason, the government and its stakeholders have invested over USD40 million towards smallholder farmers' irrigation infrastructure and extension services. The aim is to enable all-year-round high-value crop production. However, the performance of the smallholder baby vegetable farmers remains unsatisfactory as evidenced by declining numbers of farmers and inability to meet the market share. Consequently, it can be concluded that the sector is not making a significant contribution to agricultural transformation and growth. There are thus growing misgivings on whether smallholder baby vegetable farmers can optimise returns from such investments, withstand the risks associated with their enterprises for them to be fully integrated into the commercial agriculture value chains.

The main objective of the current study was to investigate the dynamics of the government-supported smallholder baby vegetable farming in Eswatini to suggest an integrated smallholder farmer high-value production framework. Data was collected through application of mixed method approaches such as the face-to-face interviews and focused group discussions. Qualitative and quantitative data were collected and analysed to address the following objective:

- A. To characterise the allocative and technical efficiencies of the baby vegetable farming systems
- B. To establish the risks and challenges of smallholder baby vegetable enterprises
- C. To assess the financial literacy levels of smallholder baby vegetable growers
- D. To develop a framework for smallholder high-value crop production.

8.2 Main Findings and conclusions

8.2.1 Characteristics of production efficiencies in the baby vegetable farming systems

The average of the growers was 48 years with the oldest farmer being aged 75 years. Two-thirds (67 %) of the growers were female. In addition to this, more than half (53 %) were adults. Pensioners and youth constituted 30 % and 17 % of the growers. Most of the growers (63%) were members of households that had 6-10 members. A quarter of them (25%) came from households with less than five members. Only 9% of the baby vegetable growing households had more than six members each. Most growers (49%) had secondary

education, 18% had tertiary level, 14% with primary education and 19% had no formal education. Growers either operated full-time (74%) or part-time (26%). Approximately 60% of the growers operated in irrigation schemes with the remainder being private farmers.

8.2.2 Production Efficiency Levels of Baby Vegetable Enterprises

The average technical efficiency was 50% with a range of 8% to 84%, with 44% of respondents recording below the average TE. There were 53% respondents between 50% - 75% TE while 4% recorded above 75% TE and were recorded only from private growers under SFA method. The average respondent could reduce the number of inputs used in production by 40.8% to attain the maximum technical efficiency level (84%) recorded for the group. The respondents observing the least TE level (8%) can benefit from a 90.5% reduction in the number of inputs used if they could operate at the maximum TE (84%) recorded for the group. Fertiliser was significantly overused in the production process.

Average allocative efficiency levels were 53% on a range on 9% to 84%. Result show that a potential exists for an average farmer to improve farm returns by 47% through maximising (100%) resource allocation efficiency levels. Two elasticities were significant in determining AE, seed cost (0.237, $p < 0.001$) and fertiliser costs (0.469, $p < 0.001$). There exists a potential to reduce seed cost by 76.3%, while an optimized fertilizer allocation will save cost of production by 53.1% for the same level of output.

An average EE is 29% for the respondent, wherein the lowest is 10% while the highest is 67%. The largest group was 28% of the respondents who recorded between 30 to 40 % EE, while 5% had above 60%. The least efficient farmer needs to reduce production costs by 85.1% to realize the highest EE while the average farmer should reduce production costs by 57% to reach the highest EE recorded in the group.

The implication of these results is that diversity in the characteristics of smallholder baby vegetable farmers might explain the variation in farm gross margins. Farmers with higher education levels and large household sizes were associated with higher profit margin. This means that low profit margins could be linked to low education levels and limited production skills and may operate through low technical and allocative efficiencies. With limited skills, the farmers are less likely to adopt more efficient and cost-saving farming methods, including harvesting, and grading of the crop produce. Small family sizes reveal limited labour available at crucial times of the enterprises, such as during harvesting. This necessitates hiring labour, which may be not readily available, unreliable, and expensive. That most of the respondents were female suggests that they do not benefit much from social networks with

others outside their areas of operation mainly because of competition for time with household duties.

The technical and allocative efficiency levels were low implying high economic inefficiency. This was associated with underuse of fertiliser and other inputs as well as low technical efficiency production techniques and small size of the land on which they are farming. Low use of fertiliser implies less than potential yields are realized while small land size could not be efficient if the production skills of growers are limited. The level of efficiency of female smallholder baby vegetable farmers was lower compared to the male counterparts. Retaining skilled labour was a challenge which could be limited by liquidity levels of farms. Baby vegetable production demands high technical efficiency practices, however, low technical and allocative efficiency levels recorded could be due to limited levels of education among the farmers which limited their skills levels.

8.2.3 Financial Literacy Levels of Smallholder Baby Vegetable Growers

Objective two investigated the financial literacy and financial inclusion levels of the smallholder baby vegetable farmers in terms of how it influences enterprise economic management decisions. There were 96.5% respondents who were mobile money account holders, 79% had bank accounts and 43.9% were members to self-help groups. Ninety-three per cent of respondents used MM for receiving money and 75% used it to make purchases. The dominant use of MM could be due to limited proximity to banking services as well as fewer conventional banks' branches in these production areas. However, MM accounts services were limited in enabling farmers to save some earnings and use credit services. This implies that most respondents could not save for future enterprise requirements. Therefore, they had to rely on external sources to finance season to season production which is not only expensive but also does not give them the required financial and investment flexibility.

There were 35% respondents with good financial knowledge which show low awareness in the group. A significant variation (60.9%, $p = 0.000$) was recorded on financial knowledge of the group where private growers had good financial knowledge than their counterparts. The financial knowledge, behaviour and attitude of respondents were significantly low, and it can be concluded that most of the respondents had unsatisfactory financial literacy levels. The implication is that they cannot make significant contribution to the sector developmental goals. It was also concluded that financial literacy could also be influencing their economic efficiency level.

In objective three the assessment of the risks and challenges associated with smallholder baby vegetable production was undertaken. The key findings show that fluctuating product prices and late product payments were the two most significant risk factors to the sector. These affected the liquidity of the enterprises' economic outcomes. The clustered irrigation schemes were significantly affected by market risks while private growers experienced production risks. About 35% of private growers produced in areas prone to weather variability experiencing hailstorms and floods which increased crop losses.

Market risks were driven by high rejection levels of the products in the market and high labour costs. Product rejection where the quality may not be meeting the market requirements lowered the share of sales per harvest season. Therefore, lowering the economic returns of the enterprises. This results in unsustainable production which heavily load on the government support. The competition for labour with forestry activities weakened the retention of skilled labour in these enterprises.

To conclude on results, all three null hypotheses of the study are rejected. Accept H_{a1} : production inefficiencies exist in the enterprises, where technical, allocative, and economic efficiencies average was 50%, 47% and 71% respectively. Accept H_{a2} : The group had poor financial literacy, with a mean (5) score was lower than the benchmark (7) score. Financial literacy of growers in this sector is not adequate as financial knowledge, financial behaviour and financial attitude were below benchmarks. Lastly, H_{a3} was accepted which says, risk exposure of farms is not homogenous. Results show that private farms were significantly prone to production risks while irrigation schemes were affected by market risks.

8.3 Recommendations

8.3.1 Objective A: To establish the level of production efficiency of smallholder farm enterprises.

It is recommended that extension services be engaged to build capacity of growers for technology adoption and use to improve profits. There was, however, majority of adult growers (maximum age 75years) with secondary education, only 17% were youth. Locating youth involvement in the value chain could enhance adoption of technology as well as harvest handling. The education and skills level of the youth foster ease of technology adoption which harness innovation that may also alleviate labour demands. Innovative ways of production, harvesting and grading methods that meet market standards could increase farm profits and promote sustainable enterprises. On the observed high production inefficiency levels in these enterprises, extension support should be intensified to build farm

capacity to correctly use farm inputs. Enabled access to credit could enable the adoption of improved technology and infrastructure improvements. Interventions to improve allocative and technical efficiency would enhance yield levels through emphasis on optimal use of farm input levels and adoption of cost-saving methods.

8.3.2 Objective C: To characterize the challenges of venturing into smallholder baby vegetable enterprises.

Adoption of improved production technology is recommended towards protecting and mitigating against crop losses to weather variability. Youth involvement into production in this value chain is recommended as they are more trainable towards comprehending production technologies and market quality requirements. Adherence require harvesting at the right maturity and size of crops to increase shares of crop sales that enable high returns to farms.

Interventions are recommended for improvements in transportation and warehousing of the product to preserve the value of the harvest. Building packhouses closer to producers could reduce harvest-to-grading time and improve the warehousing payment system. Creating sustainable enterprises through high economic returns would boost skilled labour retention in the sector thereby creating a foundation for resilience towards the green growth objective.

8.3.3 Objective C: Financial Literacy Levels of Smallholder Baby Vegetable Growers

Financial literacy and financial inclusion levels of farmers presented that respondent are not saving their earnings but borrow to finance farm activities thereby using expensive capital. Outreach programs by the banking sector is recommended to enable financial inclusion and literacy of growers. With increased bank visibility and use of banking services, the financial management education of farmers could be improved through collaborative efforts of extension and banks. Programs should be closer to farmers and foster financial management knowledge to the growers to impact expenditure and saving decisions. Amidst mobile money accounts, growers need investment accounts that serve the non-recurrent expenditure requirements of the farms. Furthermore, youth involvement, from their literacy, would create demand for financial inclusion services that meet the production cycle needs of the enterprises. Extension service training too, is recommended to extend the scope of farmer assistance to include the record keeping and finance skills.

8.3.4 Development Framework for An Integrated Smallholder High-Value Crop Production

Results showed that age, education level and labour influenced production returns from these enterprises. The inherent effect of farmer characteristics impacted the enterprise

efficiency levels where input use levels and cost allocation decisions lowered economic returns to farmers. High financial illiteracy of farmers also affected the saving and investment decisions to meet farming requirements. Market and production constraints to production were attributable to liquidity conditions, levels of innovation and technology adoption in these farms. The proposed strategy for integrated high-value crop production in smallholder farms seek to enhance the efforts towards improving the sectors contribution to economic development. This purpose is aligned to enabling poverty reduction (SDG 1) and provision of decent incomes to these growers (SDG 8). The strategy is presented in figure 8.1, indicate the key pillars in a high-value commodity system that seeks to empower smallholder growers to be resilient high-quality producers for the green growth objective as well as be economic players to impact rural development. These are A) Developing capacity for allocative and technical efficiency of smallholder farms, B) Develop farmer financial literacy, and C) Advance a sector risk management program.

A. Developing Capacity for Allocative and Technical Efficiency of Farms

Extensive farmer training on proper use and optimization of farm inputs through extension services would enable improvements in technical efficiency levels as required for economic benefits. Interventions into improving farm management capacity of growers are essential towards enabling budgeting skills and expenditure decisions to improve allocative efficiency. Youth involvement in the sector would foster technology adoption and innovative harvesting methods to also impact farm economic efficiency through high sale volume. Crop protection technologies should also protect the crop from hailstorm and frosts, as well as enable drainage of the fields. Field drainage limited access to harvest during prolonged rains, therefore, resulting in oversized products that lower seasonal crop sales.

B. Sector Risk Management Program

Sector risk management program should target to improve crop protection against weather variability to enable consistency of supplies in the market to meet demand. Aligned to crop protection, is investing in technology that enable drainage fields. Drainage limits access to the field for harvest where responsiveness to weather and supply is essential in enabling preservation of farm returns. Packaging and transportation of the crop should therefore preserve value of harvest, as well as enable prompt product grading system after harvest. Furthermore, improve financial flows through payments for farm liquidity requirements for

green growth. This is linked to the need for governance and policy including investment into an intensive supplier information system that could enable information asymmetry and early warning platforms.

C. Enhancing Farmer Financial Literacy

Intervention should target intensifying outreach programs by banking institutions in these production areas to increase visibility and enable ownership and use of financial services by the farmers. In this group, financial inclusion was significant in influencing expenditure decisions. Management practices in the smallholder farms was inherent of the non-saving behavior, use of expensive capital and no record keeping. Collaboration of the extension service and financial institutions towards farmer training in finance and record keeping could built their capacity to save and inspire farm capital investments. Lobbying for youth participation in the sector could catalyze the demand for financial services suited to the high-value crop production demand cycle.

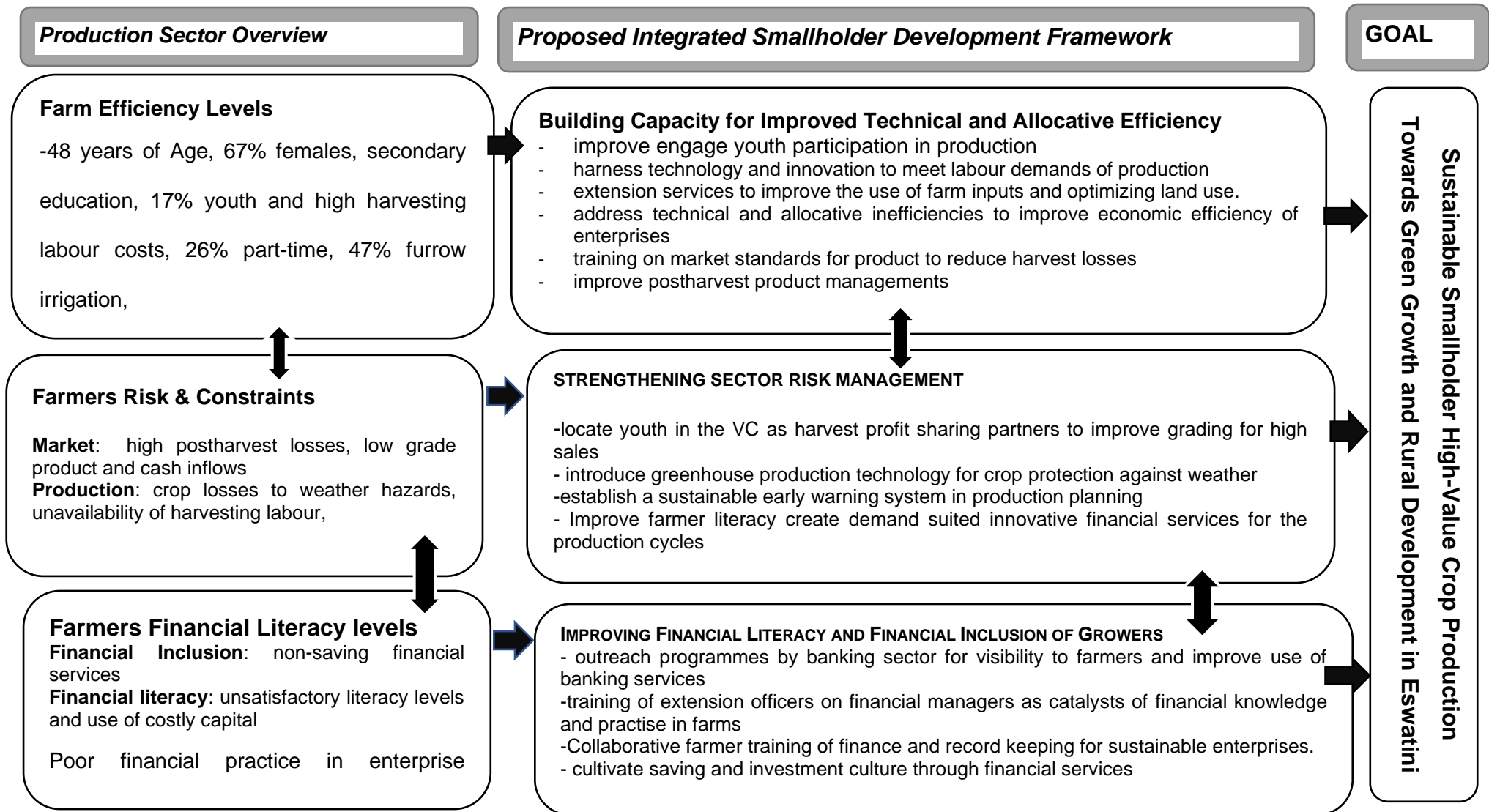


Figure 8. 1: Strategy for An Integrated Development of Smallholder High-value Crop Production

8.4 Future Research

Future research could target to investigate the following issues:

- a) Assessing the feasibility of involvement of technology savvy youth in the sector to improve efficiency levels from better technology adoption.
- b) Considering the high losses associated with weather hazards in the sector, explore the development of a context specific greenhouse technology for the baby vegetable sector.
- c) Using the value chain analysis approach to locate and quantify the harvest and postharvest losses at each node of the smallholder value chain to inform a remedial strategy towards improving volume of sales.
- d) Evaluating the viability of the proposed integrated development of smallholder high-value crop production in Eswatini.

8.5 Contributions Made from the Study

8.5.1 Theory and Methodology

Radcliffe *et al.* (2018) recorded that success in rural transformation is driven by inclusion, flexibility, empowerment ownership and effective communication among agents. Similarly, agricultural transformation is realised through efficient and innovation ways of production for high farm returns. Economic transformation, therefore, is to be achieved through a process that involves new inclusive approaches to innovations that give more space to rural smallholder community members to take an active part in shaping solutions to the growth problems they face. This is an aspect sought in enabling financial and high-value chain integration of the smallholder baby vegetable farmers. The use of a mixed-method approach is adopted in health sciences for its attributes of reliability, validity, and replicability. Statistical analysis of quantitative results used econometric principles on the data envelopment analysis and Stochastic Frontier Analysis. Combining the use of the two efficiency methods enabled the establishing the method that better-explained group variation and robustness of findings. Triangulation of the quantitative and qualitative results provided the baseline information which were building blocks for the proposed development framework in the sector.

8.5.2 Scholarship

A. Methodological Rigor

The scholarship of engagement principles in the theory of change were employed in the study processes. From community entry, stakeholder assistance in respondent identification, key

informants' interviews as validation of research tools. As a collective, these provided a broader understanding of the status quo and the needed interventions that inform the proposed framework. Scholarship of integration is presented in the use of sequential methods in the data collection and analysis for the results presented. The nexus of farm efficiency, financial integration and risk probabilities enabled the understanding of smallholder high-value crop farming challenges.

B. Publications

Two manuscripts were prepared from this research project.

1. Accepted by the MPDI journal of Agriculture
Dlamini D. D; J. Zuwarimwe; J. Francis; A. Mchau (2021). Risk Factor Assessment in the Smallholder Baby Vegetable Cold Chain in Eswatini. *Agriculture*, 11, x. <https://doi.org/10.3390/xxxxx>
2. Accepted and published by the Academia journal of Agricultural Research
Dlamini D. D; J. Zuwarimwe; J. Francis; A. Mchau (2020). Assessment of Cost Optimization in Smallholder Baby Vegetable Production in Eswatini. *Academia Journal of Agricultural Research*. DIO: 10.15413/ajar.2020.109

8.6 Limitations

Use of cross-sectional data in this study did not include the long-term experience of the growers in the industry wherein presenting a limitation on the reflection on all the agronomic practices in the enterprises. Size of the population limited the inclusion of socio-economic dynamics in the estimation of inefficiency effects. Data was also collected in the 2018/2019 production season, a season that recorded hailstorms in highveld region of Eswatini. The COVID-19 pandemic posed limitations to further field observations and contact for the study. Using time-series data could even out variability of farm efficiency and literacy levels recorded in the group.

8.7 Feedback and Dissemination Plan

Grimshaw *et al.* (2004) observed that most studies lacked feedback reports to the populations mainly due to the lack of developed dissemination guidelines and the costs of reporting. Results of this study would be disseminated in various platforms to enable awareness and adoption through the published in relevant journals for adoption by the academia. Feedback with relevant stakeholders would be organised to advice on the outcomes of the research and how these can be adopted to improve the status quo. A Policy brief would be prepared and

shared with policy makers for as an indicator of the current results of policy and what interventions and mechanisms crucial for improving smallholder in the government-supported baby vegetable value chain.

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Appendix 1

1 Project approval by University of Venda Higher Degrees Committee

UNIVERSITY OF VENDA

OFFICE OF THE DEPUTY VICE-CHANCELLOR: ACADEMIC

TO : MR/MS D.D DLAMINI
SCHOOL OF AGRICULTURE

FROM: SENIOR PROFESSOR L.B KHOZA
DEPUTY VICE-CHANCELLOR: ACADEMIC

DATE : 12 JUNE 2018


DECISIONS TAKEN BY UHDC OF 12th JUNE 2018

Application for approval of Thesis research proposal in Agriculture: D.D Dlamini (17023790)

Topic: "Dynamics of Government-Supported Smallholder Baby Vegetable Farming in Swaziland."

Promoter	UNIVEN	Dr. J. Zuwarimwe
Co-promoters	UNIVEN	Prof. J. Francis
	UNIVEN	Prof. G.R Mchau

UHDC approved Thesis proposal


Senior Professor L.B. Khoza
ACTING DEPUTY VICE-CHANCELLOR: ACADEMIC

Appendix 2 – Ethical Clearance

RESEARCH AND INNOVATION
OFFICE OF THE DIRECTOR

NAME OF RESEARCHER/INVESTIGATOR:
Ms DD Dlamini

Student No:
17023790

PROJECT TITLE: Dynamics of government-supported smallholder baby vegetable farming in Swaziland.

PROJECT NO: SARDF/18/IRD/11/2906

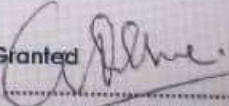
SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

NAME	INSTITUTION & DEPARTMENT	ROLE
Dr J Zuwarimwe	University of Venda	Promoter
Prof J Francis	University of Venda	Co - Promoter
Prof A Mchou	University of Venda	Co - Promoter
Ms DD Dlamini	University of Venda	Investigator – Student

ISSUED BY:
UNIVERSITY OF VENDA, RESEARCH ETHICS COMMITTEE

Date Considered: June 2018

Decision by Ethical Clearance Committee Granted

Signature of Chairperson of the Committee: 

Name of the Chairperson of the Committee: Senior Prof. G.E. Ekosse



University of Venda

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Appendix 3 Data Collection Tools - Phase 1 Study Questionnaire

DYNAMICS OF GOVERNMENT-SUPPORTED SMALLHOLDER BABY VEGETABLE FARMING IN SWAZILAND



Consent to Participate in a Research Study

DYNAMICS OF GOVERNMENT-SUPPORTED SMALLHOLDER BABY
Title of Study: VEGETABLE FARMING IN SWAZILAND

Researcher:

Name: Dlamini Delsile Daisy Phone: +27 79 776 5014

Email: ddaisdlamini@gmail.com +268 7641 7604

Introduction

You are kindly requested to part in this research study of '**Dynamics of Smallholder Baby Vegetable Farming in Swaziland.**' It involves data collection on the farm and socio-economic characteristics, industry perspective as well as the relations within the industry to ensure attainment of production growth and efficiency in smallholder baby vegetable production. It is research conducted in partial fulfilment of Ph.D. in Rural Development for the researcher hosted by the University of Venda, South Africa. You were selected as a participant because you are a baby vegetable farmer, and you are selling through the National Marketing Board.

Purpose of the Study

It is an academic study to establish smallholder baby vegetable production dynamics in Swaziland. Its specific objectives are to establish how smallholder producers are supported and how they are enabled to deliver the quality product needed by the export market while capturing maximum benefits through their operations. Support includes information, training, extension, and financial services and farms business management skills.

Description of the Study Procedures

Any information you will provide will be used solely for academic purposes. Please note that your participation is strictly voluntary. It means you can opt to pull out any time should you feel uncomfortable. I would also like to request permission to take photographs and record some of the discussions which will be used as evidence solely for the study.

Consent

- Your signature below indicates that you have decided to volunteer as a research participant for this study and that you have understood the information provided above.

Subject's Signature:

Researchers
Signature:

Date:

Questionnaire No:

**DYNAMICS OF GOVERNMENT-SUPPORTED SMALLHOLDER BABY VEGETABLE
FARMING IN SWAZILAND**

Date:

Constituency.....

Area:

RDA:

Respondent's Name:

Cell Number:

Please circle where appropriate.

A. DEMOGRAPHIC CHARACTERISTICS

Q. #	Question	Code
1	Gender of the farmer [cross one] i) Female ii) Male	
2	How old are you? Years	
3	What is your marital status? i) Single ii) Married iii) Widow iv) Divorced v) Separated	
4	What is your household size? Number of people	
5	How long have you been consistently growing baby vegetables? years	
6	Do you have a bank account? Yes/No	
7	If yes , which type? i. Ordinary saving ii. Cheque account iii. Investments/Shares iv. Other (state).....	
8	If no , state reason	

9	Do you have a cell phone? Yes/No	
10	<p>A. Do you use your cell phone for following? Cross (X) the relevant</p> <p>a. Receiving money</p> <p>b. Making direct payments</p> <p>c. Save money</p> <p>d. Money transfers</p> <p>e. None of the above</p> <p>B. If not, state reason</p> <p>_____</p>	

Q. #	Question	Code
11	Year of formal education (Number of years)	
12	Are you employed now, apart from working on the farm? Circle one	
	<p>i) Yes</p> <p>ii) No</p>	
13	<p>C. If yes, which occupation?</p> <p>i. Professional</p> <p>ii. Vocational</p> <p>iii. Farm worker</p> <p>iv. Domestic workers</p> <p>v. Industry Labourer</p> <p>vi. Other (state) _____</p>	
14	Are you a member of a farmer group? Yes/No	
15	If yes , which farmer group? Circle one	

	<ul style="list-style-type: none"> i. A farmer's union ii. Vegetable growers' association iii. A stockvel/ savings group iv. Local baby growers' association v. Other (state) 	
16	Experience in cultivating baby vegetables? Years	
17	<p>What is the tenure of your farm? Cross one</p> <ul style="list-style-type: none"> i) Swazi nation land ii) Title deed land iii) Lease 	
18	<p>What is the type of soil on which you grow baby vegetables? Cross one</p> <ul style="list-style-type: none"> 1. Sandy soil 2. Loam soil 3. Clay soil 4. Silty soil 5. Other specify..... 	
18	What is the total size of your farmland? (Hectares)?	
19	How much of your land is used for baby vegetable production? Hectares	
20	<p>How did you get to part take in baby vegetable production? Cross one</p> <ul style="list-style-type: none"> i. Through a friend /other farmers ii. Through selection by NAMBoard iii. My own Personal motive iv. Advice from extension officer v. Other 	
21	<p>If selected by NAMBoard, state the reasons given_____</p> <p>_____</p>	

22	Would you like to expand your baby vegetables production area? Circle one Yes/No	
23	If yes , what problems would you encounter? Circle one i) Lack of finance for inputs ii) Shortage of labour iii) Other problems (specify).....	
24	Which is the one major baby vegetable crop you prefer to grow? _____	
25	State your justification for choosing this crop as your major crop in Q25 above?	
26	How do you deliver your product to the market? cross one a. Through a local collection center b. On-farm collection by the buyer c. I deliver a product to the buyers d. Other (state).....	
27	What is the distance of your farm to the market? Use one A.Kilometers OR B. hours	
28	Which value addition do you undertake on the baby vegetable harvest before selling it? Circle one i. Grading/sort ii. Packaging iii. Washing iv. None	
29	If none , state reason	

B. PRODUCTION AND INPUTS COSTS		
30	<p>What is the source of finance for your baby vegetable production?</p> <ul style="list-style-type: none"> i) Personal / Savings ii) Bank loan iii) Cooperatives iv) Association v) Government vi) Other (specify)..... 	
31	<p>Did you use a loan for capital funding to start your business? Yes/No.....</p>	
32	<p>If yes, for what was the capital funding it used for?</p>	
33	<p>If no capital funding used, state Why?</p>	
34	<p>Do you have enough funds to finance your baby vegetable enterprise? Yes/No.....</p>	
35	<p>If no, which financing is most affected in your farm business? Circle one</p> <ul style="list-style-type: none"> i. Operating inputs ii. Capital assets 	
36	<p>Are family members used as a source of labour? Yes / No.....</p> <p>If yes to use of family labour, in which tasks do your family members participate in, indicate with a tick, and fill the number of days taken Q38 below</p>	
37	<p>Do you use hired labour for in baby vegetable enterprise? Yes/No.....</p> <p>If yes, in which tasks do you engage hired labour, indicate with a tick, and fill the number of days taken. [Complete form provided below Q38 below]</p>	

Q38. Use of family labour

a: Number of hours worked day _____ per day

Operation	Man	Number of days	women	Number of days	Children	Number of days	Total labour
Land clearing							
Ploughing							
Planting							
Weeding							
Harvesting							
Marketing							

Q39: Use of Hired labour

a: Number of hours' workers work per day _____ per day

Operation	Rate of pay / operation /Day	Number of women	Number of days	Number of men	Number of days	Number of youths	Number of days	Total man/days labour
Land clearing								
Ploughing								
Planting								
Weeding								
Harvesting								
Sorting / grading								

Q. #	Question	Code
40	How many baby vegetable crop cycles you have per year? _____	
41	With factory grading, has your product been rejected lately?	

	Yes/No.....	
42	If yes , state reason given for crop rejection.	
43	How do you receive payment for the produce? a. Bank transfer b. Mobile money transfer c. Cash d. Cheque payments	
44	When do you receive payment for your produce? e. Same day f. Less than 3 days g. In a week after delivery h. Other, (state).....	
45	In the table below, give information about your crop sales for the year 2017	
46	What are the quantities and costs of inputs in your baby vegetable production? (Please fill in the table Q46)	

Q46: Information on Crop Sales

Crop	Do you grow this crop?	Scale or size of the Plot used?	Price/kg	Harvest 2017 (number of crates)	% Crop reject	Do you have an alternative market?	alternative price
Baby marrows							
Yellow patty pans							
Green patty pans							
Baby germ							

Green beans							
Baby cauliflower							
Red cabbage							
Green cabbage							
Savoy cabbage							
Sugar snap peas							
Mangetaut							
Fennel							
Baby carrot							
Chillies							
Baby corn							
Other							

Q47: Quantities and Costs of inputs in your baby vegetable production

Inputs	Quantity used	Total costs (E)
<u>Tractor costs (hours):</u>		
Ploughing		
Planting		
Cultivation		
Seeds (kg)		

Seedlings (kg)		
Herbicides (litres)		
Pesticides(litres)		
Fertilizer: (kg)		
Basal dressing		
Topdressing		
Lime application		
Packaging material		
Plastic picking bags		
crates		
Transport costs for inputs		
Transport costs for baby vegetables		
TOTAL (Q48)		

Q. #	Question	Code
49	Where do you get the farm inputs? i. But local supplies ii. Under produce supply contract with NAMBoard iii. Grow organic iv. Other (state).....	
50	Do you have access to winter irrigation water? Yes/No	
51	If yes , state source of winter irrigation	
52	If NO , state reason for no winter irrigation	

C. CROP MANAGEMENT PRACTICES

Q. #	Question	Code
53	When do you plant your baby vegetables seed? i) All year rounds ii) Only During the growing season iii) Other (Specify).....	
54	Which weed control means do you apply? i) Chemical ii) Manual iii) Both iv) Other (specify).....	

C. Technical Assistance

Q. #	Question	Code
55	Do you receive any extension services/visits on your baby vegetable production? Yes/No....	
56	A. If yes, how many visits do you get a week? times a week B. From whom? 1. NAMBoard 2. Government extension service 3. NGO, state which.....	

Q. #	Question	Code
------	----------	------

57	Did you receive any training for baby vegetable production? Yes/No	
58	If yes, what type of training? Refer table Q58	

Q58: Type of Training on baby vegetable Production

Training	Delivery mode (Q58)	Duration (Q59)	On a scale of 1- 10, rate the usefulness of training in everyday farming (Q60)
Husbandry			
Pest & disease			
Quality production			
Grading system			
Business management			
Other (state)			

**** mode of delivery can be a meeting, workshop, short course.**

Q61: Source of Information

Training	Information source
1. Husbandry	
2. Quality production	
3. Seeds and chemicals to use	
4. Enterprise financing	

5. Market Prices	
6. Cash-flow management	
7. Investment decisions	
8. Insurance	

Q.62	Question:						Code
	Rate your experience with of the following production and market challenges? [scale= 1 = <i>not likely</i> , 2 = <i>less likely</i> , 3 = <i>not sure</i> , 4 = <i>likely</i> , and 5 = <i>more likely</i>]						
	Lack of funds						1 = <i>not likely</i> , 2 = <i>less likely</i> , 3 = <i>not sure</i> , 4 = <i>likely</i> , and 5 = <i>more likely</i>]
	Unavailability of inputs						
	Inputs are expensive						
	Distant Market						
	Inadequate technical information						
	Produce collection failure						
	Any other (specify)						
Q. #	Question						Code
63	What opportunity exist for you as a baby vegetable farmer in Swaziland?						

D. COORDINATION EFFICIENCY

Complete the following table as shown in the second column. (Circle one where possible)

Key Element	Type of variable
-------------	------------------

<p>64. Payment system</p>	<p>a. How soon do you get paid after delivery?days</p> <p>b. Which Mode of payment used?</p> <p>c. How do you receive payment? (Circle one) (1) <u>Collect</u> (2) <u>direct transfer</u> (3) other state.....</p> <p>d. Rate the efficiency of the paying system on a scale of 1 to 10</p>
<p>65. Product Collection system</p>	<p>a. Collect or delivered? - Collected (1) otherwise (0)</p> <p>b. Owner of transport - NAMBoard (1) otherwise (0)</p> <p>c. Mode of transport - Refrigerated (1) none-refrigerated (0)</p> <p>d. Time of collectionam /pm</p> <p>e. Cycle of periodic collection. Every days</p>
<p>66. Grading System (Circle one)</p>	<p>a. Point of grading - On-farm (1) otherwise (0)</p> <p>b. Training on standards - Yes (1) no (0)</p>

E. Risk Assessment [rank your experience in the past three years on the following on your farm]

Q67	Variable	Ranking scale: 5=strongly agree; 4=agree; 3=do not know,2=disagree, 1=strongly disagree
	- Sudden change in output price	
	- Sudden change in input price	
	- Sudden change in output	
	- Sudden change in product demanded	

- High prevalence of Pest and diseases	
- Sudden change in wage rate	
- Prolonged drop in price of output	
- Sudden change in labour availability	
- Product collection failure	
- Delayed payments	
- Other (state)	

F. Financial Knowledge

variable	Question	Code
Q68. Financial Knowledge.	Given the capital of E1000, and you are to use 60% of it on crop A and 40% on crop B. how much are to spend on crop A and B? Answer? What is 60% of E1000? What is 40% of E1000?	
	Farm savings of E1000 keep in a safe for future use. After 2years time, will it still buy the same basket of farm input? Why? Answer?	
	Given E1000 loan at 10% interest per year to be repaid once after 6 months (season). How much will you repay in total after 6months? Answer? Loan + interest = E.....	
	Farm savings of E1000 are <u>kept</u> in a bank for future use with no additions over the years, do you expect to find the money in the bank? Choose/circle one answer below 1. same amount 2. more amount 3. less amount State why? _____	

	Farm profit is money left after all farm expenses are paid in full. True or false? (Circle one)	
	When farm profit is 10% and interest on loan is 12%, you can borrow/take loan? Answer?	
	Inflations means cost of living is increasing rapidly. True or false? (Circle one)	
	The higher the risk, the higher the return. True or false?	
	Can you reduce risk of losing on farm earnings by putting money <u>in</u> different financial investments? Yes, or no?	

G. Financial Behavior and Attitudes

On a scale of 1 to 5, where 5- Strongly agree, 4- Agree; 3- Not Sure, 2- Disagree, 1- Strongly Disagree

Variable	Question	Rate (Scale of 1 to 5)
Q69 Financial behaviour	1. I spend according to the business plan	
	2. Carefully consider prices before buying	
	3. Pay farm bills on time	
	4. I keep close watch on farm expenditures	
	5. I have set farm expenditure plan and I stick to it	
	6. Each crop enterprise has its budget which I adhere to	
	7. I often borrowed to cover farm expenses	
	8. I save a fixed amount every month from my farm income	
	9. I have bought a financial investment in last 12month	

	10. I save only when excess is recorded	
	11. I gather information first before choosing farm input suppliers	
	12. I make shop around for available financial service providers and understand their benefits before making a choice	
	13. On financial products to use, I take what my bankers advise on.	
Q70 Financial Attitude	I. I am satisfied spending than saving for long-term	
	II. I produce to live for today, tomorrow will take care of itself.	
	III. I believe money is to be spent.	

H. Financial Services

Please Tick (√) the relevant answer per row

Q71. financial services	financial Products	Purpose	
		For farm enterprise	For personal use
i. Transfer payments	Bank deposit		
	Mobile money		
	Use cheque		
	Internet transfer		
ii. Transfer Deposits	Direct deposit		
	Electronic transfer		
	Cooperative		
	Stokvel (Self-help groups)		
	Mobile money saves		
iii. Receive payments	Direct Bank deposit		
	Cheque		
	Mobile money payments		
	cash		

iv. Investments/Savings	Mobile money saves		
	Fixed deposit		
	Buy Shares		
	cooperative		
	Stokvel (Self-help groups)		
	Ordinary Savings account		
v. Insurance	Credit cover		
	Business cover		
	Crop cover		
	Life cover		
	Other (state)		

Identifying subjects for focused group discussions.

- A. Are you willing to take part in the second phase of the research, a focused group discussion organized with other baby vegetable growers in your area?
- i) Yes
 - ii) No
- B. If willing, how would you like to be contacted?
- i) A direct call on my cell number
 - ii) Send me an SMS
 - iii) Send me a what-up message
 - iv) Other (state).....

Thank you very much for your time. God bless you!!

Appendix 4 : Data collection - Phase 2

Constraints and Opportunities of Smallholder Baby Vegetable Primary Production in Eswatini



In Eswatini, the smallholder baby vegetable production is an emerging value chain targeting to link smallholder farmers to markets through export orientation. Though started in 2003 under the NAMBoard, the volumes produced by the sector have not been increasing effectively to meet market demand. This is a study looking to prove how the sector primary production can be improved. It is part of an on-going academic research on the Dynamics of Smallholder Government-Supported Baby Vegetable Farming in Swaziland.

You have been selected to take part in the study through your alliances with the sector as a vital stakeholder to its growth and development. Thank you for taking part in the second phase of the data collection for this study of Smallholder baby vegetable production in Swaziland. Kindly spare 30minutes in groups to complete the questions below, precision of your responses should be born of your experience in the sector. All information shared will be discrete and used only for the purpose of the research alone.

For follow up information contact the researcher:

Dlamini D. 0 79 776 5014/ 268 79652096

<u>Date:</u>	<u>Group category</u>	<u>Name of Members</u>	
<u>Region</u>	<u>Number per group:</u>	<u>Area/ location:</u>	<u>RA #:</u>

Constraints and Opportunities of Smallholder Baby Vegetable Primary Production in Eswatini

The table below presents the constraints listed by individual growers 1 for baby vegetable production during in phase 1 of data collection. Please Rank on a numbering scale of 1 to 10. each of the constraint listed below, where **1 is Most Important**.

A. Risks in Baby Vegetable Value Production	Ranking [scale of 1 to 10]
1. Inadequate financial flows	
2. Inadequate market information	
3. Production practices	
4. Input quality	
5. Credit	
6. Water	
7. Credit	
8. Market and supply coordination	

Justify/elaborate on the **constraints ranked 1:**

Ranking Strategies to the interventions for Improving Baby Vegetable Production

Kindly Rank all the strategies listed under each of the solutions on a numbering scale of 1, 2, 3, 5 etc., where **1 is Most Important.**

A1. Improving Production	Ranking [1, 2, 3, 4, 5, 6]
a. Improve early warning system	
b. Improving production ability	
c. Improve community liaison/cooperation	
d. Technology to support best production conditions	
e. Access to implements	
f. Improve land and water resource management	

Elaborate on the **strategy ranked 1.**

A2. Provision of inputs	Ranking [1, 2, 3, 4, 5]
a. Availability of quality inputs	
b. Ease of access	
c. Reliable sources of inputs	
d. Consistency of input material supplies	
e. Government policy and enabling environment	

Elaborate on the **strategy ranked 1**: _____

A3. Information Flow	Ranking [1, 2, 3, 4, 5, 6, 7, 8]
a. access to extension services	
b. Increase use of technological innovation to information dissemination	
c. Improve flow of market information	
d. Improve flow of information of product grading	
e. Improve flow of product receipt and grading information	
f. Improve product quality information	
g. Improve weather information flow	
h. Improve production planning	

Elaborate on the **strategy ranked 1**: _____

A4. Product Supply	Ranking [1, 2, 3, 4, 5, 6]
a. Improve harvesting and harvest handling	
b. Improve post-harvest handling of product	
c. Improve grade reporting	
d. Improve risk management ability	
e. Better pricing and incentive	
f. Improve product collection	

Elaborate on the **strategy ranked 1**: _____

A5. Market Processes	Ranking [1, 2, 3, 4, 5]
a. Improve delivery order processing	
b. Improve inventory control [stock traceability]	
c. Review payment contract	
d. Improve Transportation	
e. Improve product handling and storage	

Elaborate on the **strategy ranked 1**. _____

A6. Financial flow	Ranking [1, 2, 3, 4, 5, 6]
a. Improve financial management	
b. Improve risk management	
c. Access to financial services	
d. Improve cash-flow management	
e. Improve enterprise budgeting	
f. Business record keeping	

Elaborate on the **strategy ranked 1**: _____

A7. Sector Growth and Development Opportunity	Ranking [1, 2, 3, 4]
a. Increase investment into sector	
b. Improve governance and policy	
c. Improve innovation dissemination and research	
d. Human capital Development	

Elaborate on the **strategy ranked 1**.

Thank you
for your time.

Appendix 5 : Informant Interview Guide

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Dynamics Of Government-Supported Smallholder Baby Vegetable
Farming in Swaziland

Title of Study: _____

Researcher:

Name: Dlamini Delsile Daisy Phone: +27 79 776 5014

Email: ddaisdlamini@gmail.com +268 7641 7604

Introduction

This data collection process is part of the ongoing academic research on the Dynamics of Smallholder Baby Vegetable Value Chain in Eswatini. You have been selected to take part of the study through your alliances with the sector as vital stakeholder for its growth and development. Kindly spare twenty minutes to complete the questions below as applicable in your Institution. All information shared shall be discrete and used only for the academic research purpose.

Purpose of Study

This is an academic study to investigate the smallholder baby vegetable production dynamics in Swaziland. Its specific goals are to find how smallholder producers can be integrated into the value chain as major economic players. The constraints and opportunities

Description of the Study Procedures

Any information you supply will be used solely for academic purposes. Please note that your participation is strictly voluntary. This means you can opt to pull out any time should you feel uncomfortable. I would also like to request permission to take photographs and record the discussions which would be used as evidence solely for the purpose of the study.

Consent

- Your signature below shows that you have decided to volunteer as a research participant for this study, and that you have understood the information supplied above.

Subject's Signature:

Researchers _Signature:

Date: _____

For follow up information, please contact the researcher:

Dlamini Daisy D.

ddaisdlamini@gmail.com; 17023790@mvula.univen.ac.za

+27 79 776 5014/+268 76417604

Name:	Company name:	Respondent Designation:	Department	Contact details:

NB: SHFs = Small-Holder Farmers

1. What are the blockages that SHFs face challenges in integrating into baby vegetable value-chain structures from a perspective as a selected value-chain partner (the interviewee company)?

2. Who are the agents that form part of the value chain and how are they responsible for the shortfalls in supplying a participatory platform for SHFs?

3. Where do policy and legislation contribute to blockages in value-chain participation for SHFs?

4. What policy instruments are essential to support the development of an inclusive value system for SHFs?

5. How much do individual value-chain participants (agents "Value-Chain Participants: Agents") influence one another in supporting or not supporting SHFs to take part in the economy?

6. How can the risk in respect of agents be reduced when engaging with SHFs?

7. For policy purposes, which of the agents have the greatest impact in supporting SHFs, that is, if policy can in fact be supportive of an agent?

8. How can exogenous (external cause) variables that currently influence risk of smallholder engagement be changed to support value-chain industries' engagement with SHFs?

Thank you.

Appendix 6 : Manuscript on Baby Vegetable Risk Factors

Article

Risk Factor Assessment of the Smallholder Baby Vegetable Production in Eswatini

Daisy Delsile Dlamini *, Jethro Zuwarimwe, Joseph Francis, and Godwin R.A. Mchau

Institute for Rural Development, School of Agriculture, University of Venda, X5050, Thohoyandou 0950, South Africa; jethro.zuwarimwe@univen.ac.za (J.Z.); jfrancis@univen.ac.za (J.F.); amchau@univen.ac.za (G.R.A.M.)

* Correspondence: 17023790@mvula.univen.ac.za; Tel.:

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Zuwarimwe, J.; Francis, J.; Mchau, G. R.

A. Risk Factor Assessment of the

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+268-76417604

Abstract: The transition from subsistence to commercial production poses uncertainty and risks that require putting in place adaptive systems. Such systems are imperative for agricultural production where weather and food markets are always changing. Disregarding risk factors has a cumulative negative impact on the intended outcomes. The marginality of smallholder farmers' operational environment renders them limited to strive without government interventions. Research has proven that smallholder farmers face numerous challenges in vegetable value chains. The study sought to identify and characterize smallholder growers risk factors when producing for this value chain. A sequential mixed-method research design was adopted, and data collected from fifty-eight growers from three producer groups in the Manzini and Hhohho regions. Discriminant analysis validated the heterogeneity of respondents using the experience on risk factors. The growers were significantly affected by market and production risks. The clustered growers had a high probability of losses in the value of the harvest whereas the private growers had a high probability of yield changes. Fruit size and postharvest handling contributed to changes in the value of the harvest. An improved cold chain system could enable symmetry in the harvest scheduling and grade information as well as prompt payments. Interventions toward enabling access and use of quality farm inputs would curb yield variations. Future research could quantify yield losses at each stage of postharvest handling toward informing the risk management strategy.

Keywords: smallholder farming; risk factor; heterogeneity; enterprise; market; production

1. Introduction

Smallholder farmers have a high risk of failure as economic players in high-value chains because they have limited access to information and productive assets as well as less capacity to adjust to shocks [1]. The authors argue that a value chain analysis should consider the complexity of the value chains and the risk management capacity of the actors. A risk management system is informed by identified and

predictable risks associated with each value chain. Lipton’s theory on risk management alludes to risk identification and prediction to establish strategies for enabling positive outcomes [2]. However, risk management is a continuous process, as illustrated in Figure 1. Therefore, the capacity of smallholder farmers to make informed decisions begins with enlightenment on risk exposure and predictability.

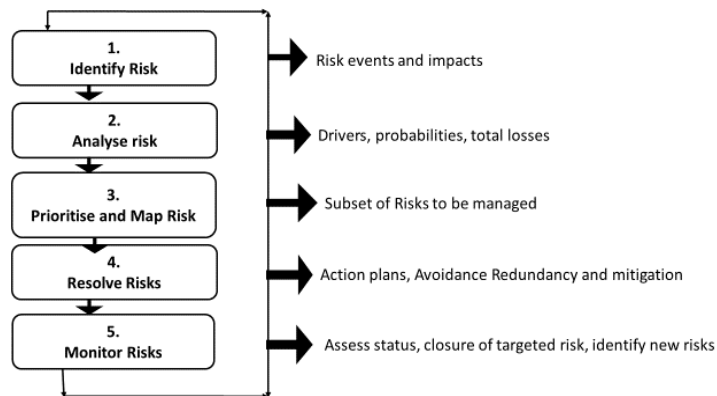


Figure 1. Risk Management Process by Smith and Merritt (2002).

The transition from subsistence farming has an inherent risk exposure, which the farmer needs to embrace for successful commercialisation. Hardaker *et al.* [3] identified five transitional risks associated with commercialisation. These are production risks, market risks, institutional risks, financial risks, and business risks. Therefore, information on enterprise risks enables a farmer to decide, given risk-averse and downside risk assumptions. Risk-averse people forgo risky opportunities whereas downside risk stimulates production within a safety principle. This is possible with predetermined risk information.

Firm commitments to development of a risk management strategy led to success in smallholder farm transformation in Thailand [4]. This was achieved through investment into adaptive research on market risks and financial access for farmers. Paramount to the transformation was adaptation through short-term investments into the high risk and volatile commodity markets. The risk perception of the farmers and experience of market failure stimulated the adoption of contract farming [5–6]. Similarly, smallholder farmers engage in farming contracts mainly for their potential to reduce market risks and the production for effective management [7]. As a tool for smallholder farmer inclusion, a well-specified contract includes extension and assistance programs that reduce barriers to capital investments and compliance with industry standards [8].

Risk orientation in the cassava value chain was the most significant factor for technology adoption in South-East Asia. Smith *et al.* [9] analysed risk orientation using a diffusion framework. The risk orientation was an important indicator of adoption as they noted that technology incentives contributed significantly to the diffusion. Islam *et al.* [10] concluded that smallholder farmers are risk-averse and lack capacity to minimise risks. Smallholder production is related to the socio-economic function where grower market conditions and resource availability require state intervention to enable a competitive ability.

The methodological basis for a risk assessment in an enterprise by Stepanuk [11] presented four risk management measurements, namely: the risk requisites, the risk factors, and the risk situation. Risk requisites are within an enterprise and its external environment, influencing the threats and opportunities of the farms. Risk factors are attributed to the conditions that increase the probability of a negative situation [12]. These rely on the precondition that a high probability of the occurrence of an event is undesirable and would cause a deviation in the strategic goals. In mental health, risk identification constitutes the causes of risk and a phenomenon that renders the promise of trouble [12]. A risk situation is a condition deemed to be a threat to the realisation of a plan. A risk function consists of significant risk factors and their probability of occurrence within an enterprise.

The major risk factors that were identified among rice farmers were market price, biological factors, and climate factors [10]. Behzadi *et al.* [13] presented two types of risk in agribusiness; these were the risks on the demand and supply sides. Supply is related to the seasonality of the production and climate effects whereas demand is concerned with resource capacity variability and market prices. Ali *et al.* [14] established that price and production risks are major risk factors for vegetable and fruit production. These authors advocated an improved information system and financial markets as well as the promotion of market-based pricing systems and yield insurance schemes.

The perception of farmers of risks and the ability to manage them is greatly affected by their risk attitude [10]. Heterogeneity is crucial in the development of interventions targeting smallholder growth through mitigation constrained-performance in delivering to the market [15-18]. Discriminant analyses have been widely used in research to establish heterogeneity in groups using common traits [19-21] as well as in classifying external observations and perceived experiences in agriculture [22-24]. Therefore, a classification analysis confirms proper clustering by using probability traits to associate with a given group. The objective of this study was to determine and characterise the smallholder baby vegetable

enterprise risk factors and the risk function thereof. It sought to establish the heterogeneity of growers on risk exposure as well as provide an insight into the risk factors toward the establishment of a risk management strategy for the cold chain.

2. Materials and Methods

A descriptive, explanatory research design that employed mixed research methods to characterise the risk factors for smallholder baby vegetable production in Eswatini. Baby vegetable production is targeted for import substitution where local vegetable consumption is heavily dependent (70%) on imports; it covers 42 metric tonnes per year [25]. A census of growers was used, and purposive sampling enabled the use of participation in the government-led smallholder development. A list of growers in the Hhohho and Manzini regions was sourced from the buyer, the National Marketing Board. These regions are diverse in climate and growers use different irrigation systems. Smallholder farm production was classified into three classes using the irrigation scheme membership: clustered production, semi-dependent production, and private production. Clustered production was on a piece of land that had an irrigation system and was divided into individual plot holdings. Semi-dependent production was an irrigation scheme held on different landholdings where members had access to irrigating water through the scheme network. The irrigation scheme infrastructure was funded by the government. Private production used an individually financed irrigation infrastructure and was not a member of any irrigation scheme.

The data were collected in two phases. A structured questionnaire administered through face-to-face interviews was employed in phase 1. A Likert scale was used to rank risk exposure where *1 = not likely*, *2 = less likely*, *3 = not sure*, *4 = likely*, and *5 = more likely*. The data were analysed using a discriminant analysis through the Social Package and Service Solution, version 26. The respondents varied in the irrigation system used and location. Phase 2 used focused mini-group discussions to gather qualitative data from eight mini-groups, which engaged twenty-eight participants. Each mini group had an average of four members. The mini groups used the group labour gang that the growers used in joint farm activities during the 2018/2019 harvesting season. It was at the peak of the harvesting season and the discussions were embedded in shared farming experiences, opportunities, and market environments. An open-ended questionnaire was used to guide the discussions to bring insight into the quantitative data. The qualitative data were transcribed and coded for a thematic analysis in ATLAS.ti, version 8.

The analysis of the data adopted a discriminant analysis approach. This is a predictive classification method developed by Fisher [26]. It used the risk perspectives of the farmer as explanatory variables and the farming groups as the dependent variables.

The specification of the discriminant function is given as follows:

$$Z = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + \dots + a_n X_n \quad (1)$$

Where a_0 = the constant; a_1, a_2, \dots, a_n = the discriminant coefficients; X_1, X_2, \dots, X_n = the discriminant variables or the risk variables identified by the farmers; and Z = a predictor rank, which was used to synthesise the risk exposure rate of the baby vegetable enterprise concerning the risk variables. The aim was to explain this value by predicting the probability of exposure of each enterprise. Therefore, Z was the irrigation scheme membership category.

The discriminant analysis enabled a classification through a series of diagnostic tests on the dataset. The hypothesis test of equality of the group required the distillation of the classifying factors through a discrimination of the ratios. The Fisher test measured the significant difference among these discriminate factors; a higher F-value indicated a higher discriminating power of the risk factor. Wilks' Lambda test presented the existence and significance of a relationship between the farm category and the risk factor. A value closest to zero was the most desirable. Small Lambda values reflected a smaller intra-category variation and a substantial inter-cluster variation, which represented significantly different cluster means.

$$\text{Wilks' Lambda } (Y) = 1 - (\text{inter-cluster variance} \div \text{total variance}) \quad (2)$$

Box's M test of equality of covariance matrices was adopted to test if the variance-covariance matrix was identical from one factor to another. The null hypothesis of the equality variance-covariance matrix was tested. A covariance matrix for different clusters must not be equal such that the M-value is the largest and the P-value is significant.

A canonical correlation presented the variation between clusters given the total discriminant function. It indicated the fraction of the variation of the function following the differences recorded among the categories. Correlation values that were closer to one were the most desirable. The number of Eigenvalues was the number of categories minus 1 ($k - 1$); here, this was represented as $(3 - 1) = 2$. This was used for Wilks' test of significance of the mean differences in the discriminant function. Furthermore, the discriminating power presented by the standardised canonical discriminant function

coefficients enabled a better grouping of the farm categories where Z was the linear relationship of the risk factors.

3. Results

3.1. Loading Risk Factors for Smallholder Irrigation Production

Using the results of the Likert scale with a mean = 3, the most frequent loading risk factors were identified for each grower group. The mean rank of the risk factors is presented in Table 1. The risk factors are the matters, problems, or objects that can ultimately influence the magnitude of change in the master plan and the cost-effectiveness indicators provided for the activity [12]. It represents the reasons, circumstances, and conditions that create an adverse situation with negative results in these enterprises.

Table 1. Risk factor loading on enterprises.

Risk Variable	Clustered Production (n = 15)		Semi-Dependent Production (n = 19)		Independent Scheme (n = 23)		Group Total (n = 57)	
	Mean Rank	Std. Dev	Mean Rank	Std. Dev	Mean Rank	Std. Dev	Mean Rank	Std. Dev
Market Risks								
Product Payments	1.67	1.234	3.74	1.727	4.78	0.850	3.61	1.790
High Input Price	2.40	1.056	3.63	1.257	3.87	1.546	3.40	1.450
Produce Collection Failure	4.20	0.862	3.11	1.595	2.96	1.551	3.33	1.492
Fluctuating Product Prices	3.47	1.407	3.58	0.902	2.65	1.369	3.18	1.297
Drop In Produce Price	3.80	1.014	3.26	1.195	1.35	0.714	2.63	1.447
Wage Rate Changes	3.27	1.280	2.74	0.933	2.26	1.389	2.68	1.270
Product Demand	3.87	1.302	2.37	1.422	1.48	1.123	2.40	1.580
Production Risks								
Yield Changes	2.60	1.242	3.79	0.976	3.96	1.296	3.54	1.297
Labour Availability	4.13	0.915	3.11	1.524	1.87	1.325	2.88	1.582
Pest and Diseases	2.33	0.900	2.89	1.329	2.13	1.517	2.44	1.337

The results showed the five most frequent loading risk factors for the group; namely, untimely payments (3.61 (1.79)), yield changes (3.54 (1.3)), high input prices (3.4 (1.45)), product collection (3.3 (1.49)), and

fluctuating product prices (3.18 (1.3)), respectively. The least frequent loading risk factor was product demand, indicating an unsaturated product market. A strong agreement was recorded for product payment as a loading factor, threatening the sector with a standard deviation of 1.79. Delayed payments affect the liquidity of farms, which impacts on the timing of production activity and the inherent quantity of the harvest obtained. Hired labour constitutes 25% of the labour costs in vegetable farms, thereby increasing the demand for liquidity.

The growers recorded that product losses rose two weeks into the harvest when the collection demand rose beyond the capacity of the buyer. The respondents recorded that an alternative market could absorb the excess crop. The respondents alluded to a greater reduction in the value of sales than anticipated. Full grading information could harmonise the sale projections between the growers and the buyer. The irrigation schemes had no cold storage facilities and means for product delivery. A long distance and load conditions contributed to the inevitably unguaranteed value of deliveries. The farms were located more than 80 km from the warehouse of the buyer, a portion of which was gravel roads. The clustered growers were significantly prone to market risks. Unique to this group were product collection failure (4.2 (0.8)), labour unavailability (4.1 (0.92)), and a decrease in the product price (3.8 (1.01)). Labour unavailability was inherent from the harvest labour demands that engaged hired labour. A high wage rate in Hhohho was influenced by a proximity to competing commercial plantations that paid more than the going wage rate. It showed a hike of 75% from the E40 per day rate in agriculture. Labour availability in critical periods constrains sustainable vegetable production [27].

The loading risk factors for semi-dependent growers were yield changes (2.79 (0.98)) and delayed payments (3.75 (1.73)), presenting a high exposure to both market and production risks. The yield variation was rated highly by those who had experienced crop losses to livestock, rodents, and overgrown products due to the inability to harvest on time. Delayed harvest could be due to the prolonged rain, which made it difficult to enter the fields. As a result, the overgrown products could not be sold. The semi-dependent growers were significantly prone to and affected by production risks, which were yield changes as well as pests and diseases. These used various irrigation systems and cultivated separated fields, which prevented them from harnessing knowledge to improve disease and pest management from rodents. This group was also prone to weather extremes that affected the crop conditions. An intervention with crop-protecting technologies through greenhouses would enable a controlled plant growth and quality. The private growers recorded a vulnerability to market risks where

product payment was the most significant loading risk factor (4.75 (0.85)). Yield changes and high input prices were also significant market factors. The supply of farm inputs was non-competitive, which presented high prices.

Group Classification Using Risk Experiences

A discriminant analysis was adopted to classify the respondents based on the mean ranks of the risk factors. The purpose was to establish if any group dynamics needed to be addressed by a policy in the risk management interventions. An equality test of the means of the risk variables showed that Wilks' Lambda values were above 0.5 and were statistically significant for all variables that formed the covariance matrix. No variable was equal to 1. Referring to Table 2, the lowest, yet most significant, Lambda value was seen in the product price. However, changes in the wage rate and crop disease occurrence were insignificant factors. An equality of means test presented the market risks, product price changes (0.43), and product payments (0.5) as the most significant risk factors for this group. These factors had a Lambda value closest to zero, reflecting that they contributed most to the recorded variability of the group. A drop in the price was attributable to the variation in the product quality of the harvest when the value was lost to postharvest handling and asymmetry in the grading system.

Table 2. The role of predictors in explaining the risk variation.

Risk Variable	Wilks' Lambda	F	Sig.
Market Risks			
Fluctuating Product Prices	0.887	3.445	0.039 *
Produce Collection Failure	0.876	3.839	0.028 *
High Input Price	0.821	5.893	0.005 *
Product Demand	0.629	15.920	0.000 *
Product Payments	0.507	26.302	0.000 *
Drop In Produce Price	0.437	34.716	0.000 *
Production Risks			
Yield Changes	0.804	6.571	0.003 *
Labour Availability	0.657	14.069	0.000 *

*= P<0.05. less than 0.05, strong factor in classification of group

Risk factors are subjective or objective activities that entail unwanted development in future events that negatively affect realising of enterprise goals [28-29]. The matrix shows the significant risk factors for

the functions and the coefficients present the relative contribution of the variables in predicting the dependent variable.

The structural matrix in Table 3 shows the significant risk factors that were used to compare the production clusters, referring to Equations (3) and (4). The classification using the loading risk factors showed that the loading risk factors significantly defined the farmer groups.

The probabilities of risk in each group, therefore, were represented by the coefficient functions below.

$$Z_1 = 0.672 \text{ FPP} - 0.833 \text{ PP} + 0.002 \text{ PD} + 0.059 \text{ LA} - 0.340 \text{ WR} \quad (3)$$

$$Z_2 = 0.106 \text{ YC} + 0.343 \text{ PDs} - 0.114 \text{ IPP} - 0.328 \text{ PCF} + 0.295 \text{ Py} \quad (4)$$

The probability of experiencing risks in each production group is presented in Table 3. Larger values indicated the high predictive power of the risk factor.

The results showed that fluctuating product prices (-0.66) were a high loading risk factor and negatively influenced the future outcomes in the clustered grower enterprises, here referred to as Z_1 . Positive and high loading was a fluctuating product price (0.57) in the clustered irrigation scheme. The large coefficient for the fluctuating product price (-0.83) and product payment (0.67) showed that the clustered growers were prone to market risks and delays in product payments were frequently observed. Contrary, yield changes (0.4) and disease and pesticides (0.41) positively and significantly influenced the future outcomes in private grower enterprises (Z_2). Negatively influencing outcome in the private group was product collection failure. Yield changes, pests and diseases are production related risks.

Table 3. The discriminating risk functions.

Variables	Structural Matrix		Coefficients	
	Function 1	Function 2	Function 1	Function 2
Market Risk				
Fluctuating Produce Price (FPD)	-0.661 *	0.447	-0.833	0.720
Product Payments (PP)	0.571 *	0.443	0.672	0.342
Product Demand (PD)	-0.449 *	-0.289	0.002	-0.609
Wage Rate (WR)	-0.202 *	-0.060	-0.340	-0.313
Input Price Prices (IPP)	0.250	0.358 *	-0.023	-0.114
Product Collection Failure (PCF)	-0.197	-0.315 *	0.146	-0.328
Product Price (Py)	-0.185	0.306 *	0.270	0.295
Production Risks				
Labour Availability (LA)	-0.433 *	-0.024	0.059	0.097
Yield Changes (YC)	0.259	0.409 *	0.342	0.106
Pest and Diseases (PDs)	-0.066	0.401 *	-0.280	0.343

* Largest absolute correlation between each variable and any discriminant function. Values > 0.3.

The growers were classified into clustered and semi-dependent growers by improving the classification error from 17.5% to 100%. The results presented that 87% of the clustered production was correctly classified whereas 13% was incorrectly classified. In the semi-dependent production, 58% were correctly classified and 42% were not. The results showed that the two types of irrigation systems were exposed to different risk factors. This could be attributable to regional locations, weather differences, and group formations.

The study verified that the variance-covariance matrices were identical from one risk variable to another, as shown in Table 4.

Table 4. The overall testing of the linear discriminant analysis model.

Parameter	Results
Box's M	259.2
F approx. (<i>p</i> -value)	1.686 (0.000) ***
Eigenvalue	2.839
% Of variation	89.1
Canonical correlation	0.855
Wilks' Lambda	0.2 (0.000) ***
Chi-squared, <i>p</i> -value	80.40 (0.000) ***

*** = significant at 1%.

A null hypothesis was tested, which stated:

Hypothesis 0 (H_0): Equal variance-covariance matrices for the intra-classes; $p > 0.05$.

Hypothesis 1 (H_1): Covariance matrix of the intra-classes is not equal; $p < 0.05$.

The null hypothesis was rejected, and H_1 was accepted, presenting that the covariance matrix of the intra-classes was not equal. Therefore, the condition of the unequal variance-covariance matrices was verified. Box's M test allowed the results to be concluded best if the Fisher was significant at $p = 0.000$; therefore, the discriminant analysis for this study was validated. It can be concluded that there was a variation in the risk factors experienced by the different respondents in the survey. Figure 2 presents the classification plot for the group, reflecting an overlap of the risk factors of the semi-dependent group across the clustered and private growers.

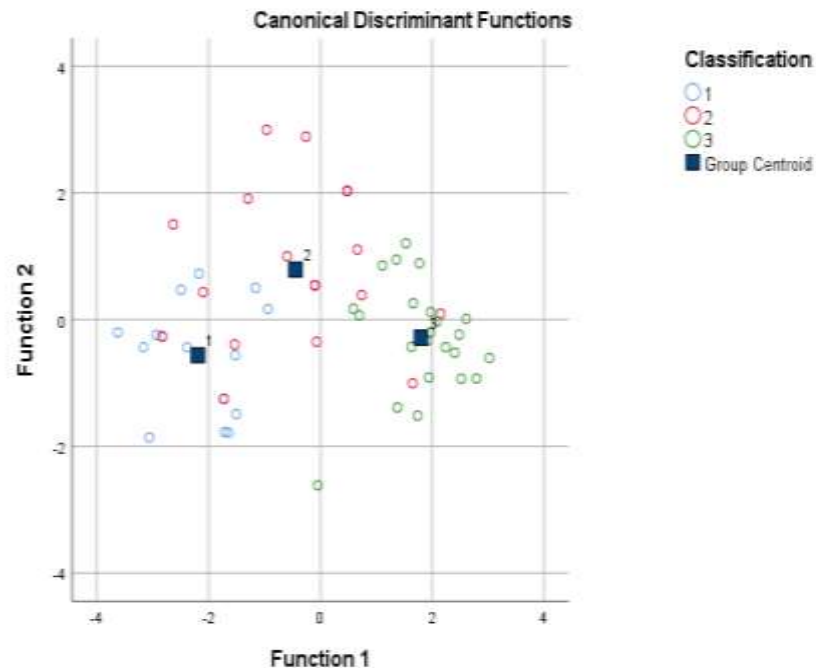


Figure 2. Discriminant classification plot.

4. Discussion

There were 76% full-time growers; 24% were part-time with an off-farm income. Kusunose [30] observed that a limitation of smallholder farmers to access credit forced a dependency on an off-farm income. Ali *et al.* [14] reported that market and production risk factors were significant in vegetable production. Our results confirmed that production and marketing risks were significant in these baby vegetable enterprises. High input prices were attributable to the non-competitive supply of the inputs. Input prices, credit constraint, farm size, and the unavailability of input on time are major factors of input supply in agriculture [31]. Also, access to quality inputs limited productivity in small-scale irrigation in Zimbabwe [32–33]. The average farm size was 1.4 ha for this group.

Fluctuating product prices were attributable to the grade value where multicoloured fruit, overgrown and a wilted harvest were under-graded and discarded. Elik *et al.* [34] presented that maturity standards, field packaging, and transportation drive losses in product quality in vegetables. A product collection failure contributed to a lower product grade through limited farm capacity in postharvest handling. Delays in product deliveries and methods of transportation are contributors to postharvest losses in vegetables [35–36]. The determinants of a method of transportation are the distance to market, product perishability, and value of the harvest [34,37].

The irrigation schemes had no cold storage facilities and means for product delivery. A long distance and load conditions contributed to the inevitably unguaranteed value of the deliveries. The harvest quality of fragile and perishable vegetables depends on transport conditions [38–40].

Labour unavailability was inherent from the harvest labour demands that engaged hired labour. A high wage rate in Hhohho was also influenced by the proximity to competing commercial plantations that paid higher than the going wage rate. It showed a hike of 75% of the E40 per day in agriculture. Labour unavailability in critical periods, such as harvesting, constrain sustainable vegetable production [14].

Overgrown fruit sizes could not be sold. Similarly, smallholder farms lacked capital investment into production technologies such as greenhouses, as observed in China [41–42]. These facilities assist with weather protection. The cost of inputs such as limited financial resources and labour during peak periods are factors that influence the yield variation [35]. Yield changes are presented through the inability to treat several pests that persist in the seasons as well as the effects of weather variations.

The high probability of product prices variation and delayed payments in the clustered production could be a lack of bargaining power [42]. Delayed payments limit the financial resources of enterprises and the use of quality inputs [31–35]. Yield changes, disease, and pesticides positively and significantly influenced the future outcomes of private grower enterprises in this group. In agreement, Stringer *et al.* [43] concluded that the production scale, distance to market, and producer contract details were the characteristics of risks in vegetable supply chains. The results present that a regard for heterogeneity in smallholder interventions is paramount in enabling the attainment of the developmental goal. Furthermore, the influence of farm resource endowment on the significance of the observed risk factors and the risk orientation of these groups should be established to guide the risk management strategy.

5. Summary and Conclusions

The use of the discriminant analysis classification method was a validated method for classifying smallholder baby vegetable growers in Eswatini. This technique improved the classification from 83% to 100% using the perceived risk factors recorded; therefore, this presented the factors of heterogeneity in these farms. The sector was significantly affected by market risks. These were expressed through low cash inflows and high input prices. Non-compliance with terms of sale in the contracts affected the cash flow of these enterprises. Delayed product payments influenced the liquidity of the farms by affecting the capital investments and the timely access and use of quality inputs in the production. The non-

competitive supply of farm inputs contributed to high input prices. Product returns fluctuated through the product quality lost after harvest, lowering the value of returns. This presented an asymmetry of grading information beyond the farm gate.

The clustered growers were more prone to market risk factors whereas the semi-dependent and private farms were predominantly exposed to both market and production risk factors. Yield changes under production risks were dominant and influenced by high input prices and crop losses to weather variability. The semi-dependent growers shared the market risk factors of both the clustered and the private growers.

Recommended are improvements to the cold chain logistic system to preserve the value and shelf life of the harvest. It should improve transportation and logistical planning as well as the symmetry of the grade information. Improvements should also be directed to investments in protecting the harvest value. Improved access of farmers to credit and the quality farm inputs is recommended to enable liquidity and yield maximisation in these enterprises.

Future research should aim to establish the farm resource endowment on the significance of the observed risk factors as well as the risk orientation of the growers, the results of which could also guide a cold chain risk mitigation strategy.

The study used a census of producing growers in the Manzini and Hhohho regions. The results should not be inferred to other regions nor generalised for the industry. However, our methodologies enabled the establishment of heterogeneity using the risk factors experienced by the group. The significance of the structural matrix and Box's M test validated the suitability of the discriminant analysis in classifying the growers using the risk factors. Furthermore, the risk probability estimates thereof presented the signals of possible deviations from the smallholder development of the master plan.

Author Contributions: This work was undertaken through a collaborative contribution from the co-authors. D.D.D. was responsible for the conceptualisation, methodology, investigation, formal analysis, and drafting of the work. J.Z., J.F., and G.R. A.M. contributed through supervision, reviewing the methodologies, and discussions.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of the University of Venda (protocol code SARDF/18/IRD/11/2906 on 4 July 2018).

Informed Consent Statement: Informed consent was obtained from the all the research subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to ethical considerations.

Conflicts of Interest: The authors declare no conflict of interest.

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Appendix 7 - Approval Letter for Data Collection/Community Entry



NAMBOARD
NATIONAL AGRICULTURAL MARKETING BOARD

OUR REF: _____
YOUR REF: _____

26 June 2019

Ms Delf'sile Daisy Dlamini
University of Venda, PHD-candidate
Box 570
Matsapha

Dear Ms. Dlamini

Data Collection for PHD Thesis

1. As the above refers, NAMBoard agrees that you collect data as per your request for the purposes of your study. Please note that all information/data received from the National Agricultural Marketing Board (Disclosing Party) is proprietary to the Disclosing Party and shall be regarded as Confidential Information, and that:
2. You are required to use the Confidential Information solely for your study not for any purpose other than as authorized by this Agreement.
3. Both parties acknowledge that the Confidential Information to be disclosed hereunder is of a unique and valuable character, and that the unauthorized dissemination of the Confidential Information would destroy or diminish the value of such information.

In addition, any breach or suspected breach of information/data confidentiality shall be reported immediately.

Yours sincerely



Tshiny Dlamini
Agri Business Manager

ALL CORRESPONDENCE TO BE ADDRESSED TO THE CHIEF EXECUTIVE OFFICER

P.O. Box 4261, MANZINI 5201, SWAZILAND
Tel: (+268) 2905-8214/5, Fax: (+268) 2905-8372
E-mail: info@namboard.co.sz

Appendix 8: Additional Efficiency Analysis Results

Table 1: DEA Results of Farm Efficiency Level

Category	Allocative Efficiency		Technical Efficiency	
	Frequency	Cumulative %	Frequency	Cumulative %
Low (0 -25%)	2	4	2	4
Moderately low (25% -49%)	10	18	8	14
Moderately high (50% -75%)	14	25	15	27
High (75% -100%)	30	54	31	55
Total	56	100	56	100

Table 2: Analysis for Group Variation in Farm Efficiency Level

Parameter	Scheme Members	Private Growers	t- test
DEA method			
Allocative	0.71 (0.25)	0.81 (0.24)	0.073**
Technical	0.72 (0.28)	0.82 (0.22)	0.000***
SFA method			
Allocative	0.555 (0.152)	0.418 (0.197)	0.1292
Technical	0.523 (0.19)	0.453 (0.223)	0.0969*

Table 3: Distribution of the Farm Efficiency Levels from the DEA Method

Efficiency Level	Allocative Efficiency	Cumulative %	Technical Efficiency	Cumulative %
less than 0.1	-	-	-	-
0.1 - to 0.19	-	-	-	-
0.2-0.29	3	5	2	4
0.3 -0.39	4	7	3	5
0.4 - 0.49	5	9	4	7
0.5 - 0.59	3	5	11	20
0.6 - 0.69	4	7	4	7
0.7 - 0.79	10	18	3	5
0.8 - 0.89	5	9	3	5
0.9 – 1	22	39	26	46
Total	56	100	56	100

Table 4: Average Efficiency level by Production Groups

Category	Technical	Allocative
Grouping		
1. Scheme farmers	0.72 (0.28)	0.82 (0.22)
Clustered	66.1 (0.27)	66.7 (0.262)
Semi-independent	77.2 (0.254)	0.752 (0.229)
2. Private Farmers	0.82 (0.22)	0.81 (0.24)
Irrigation method		
Dragline	74.9 (0.256)	75.9 (0.218)
Drip	86.7 (0.199)	84.5 (0.209)
Farrow	75.7 (0.267)	76.0 (0.258)
Sprinkler	50.1 (0.089)	42.4 (0.069)

Table 5: Efficiency by Cultivated Baby Vegetable Crops

Parameter	Baby Marrow	Green Bean	Green Patty Pans	Baby Gem	Snap Peas	Yellow Petty Pens
Technical						
Mean	0.80	0.72	0.63	0.75	0.68	
Standard Deviation	0.25	0.26	0.26	0.35	0.33	
Minimum	0.25	0.33	0.22	0.50	0.35	
Maximum	1.00	1.00	1.00	1.00	1.00	1.00
Allocative						
Mean	0.75	0.75	0.72	0.59	0.95	
Standard Deviation	0.24	0.24	0.25	0.15	0.24	
Minimum	0.25	0.29	0.24	0.49	0.90	
Maximum	1.00	1.00	1.00	0.69	1.00	0.99

Table 6: Lead farms by Area and RDA for each crop (DEA)

RDA	Ranking	DMU No.	Efficiency score		Crop	Area	Region
			TE	AE			
Ludzeludze	1	22	1	1	Green bean	Lundzi	Manzini
	1	27	1	1	Snap peas	Lundzi	
	1	29	1	1	Baby marrow	Lundzi	
	1	32	1	0.73	Baby marrow	Lundzi	
	1	37	1	1	Baby marrow	Nhlambeni	
	2	42	0.88	1	Baby marrow	Timbutini	
Luve	1	43	1	1	Baby marrow	Luve	Manzini
Motjane	1	49	1	1	Green PP*	Hawane	Hhohho
	1	50	1	1	Baby marrow	Malanti	
	3	52	1	0.69	Baby gem	Jubukweni	
	1	53	1	1	Green bean	Jubukweni	
Ntfonjeni	1	2	1	1	Baby marrow	Masingishingini	Hhohho
	1	2	1	1	Green bean	Masingishingini	
	1	6	1	1	Baby marrow	Masingishingini	
	1	8	1	-	Baby marrow	Sikhumulweni	
	1	9	1	-	Baby marrow	Masingishingini	
	1	16	1	1	Green bean	Sikhumulweni	
	1	38	1	1	Baby marrow	Nsingizini	
	1	39	1	1	Baby marrow	Nsingizi	
	1	40	1	1	Green bean	Mvembili	
	1	51	1	0.99	Yellow PP*	Jubukweni	
1	54	1	1	Baby marrow	Masingishingini		

* PP = Patty pens

Effects of Financial Literacy on Efficiency Levels of Government-supported Smallholder Baby Vegetable Farmers in Eswatini (A Review Paper)

Dlamini, D.D., Zuwarimwe, J., Francis, J. and Mchau, G.R.A.

Abstract

This paper explored the relationship between financial literacy and farm efficiency as required for better smallholder performance. Improvements in production efficiencies with proper farm financial decisions threaten long-term sustainability and growth of farm operators. A review of literature using ATLAS.ti from articles and bulletins mainly from period 2018-2022. Results show financial literacy is a product of financial knowledge, financial behaviour and financial attitude. Literature presented that more influence on financial decisions is inherent from financial behaviour. Direct impact on farm efficiency was recorded from its effect on financial resource availability, adaptation of enterprise to changing economic conditions. Owner financial literacy influences enterprise the growth objective, cashflow and risk management ability. The sustainability and entrepreneurial development are interconnected with enterprise owner FL, extension, and financing of enterprise. FL, availability of finance, risk attitude and credit access thereby mediates the impact of FL on enterprise economic performance. Financial literacy enhanced the adoption of production standards through enlightening the profit areas of the enterprise.

Keywords: *financial literacy, farm efficiency, economic performance, smallholder enterprise.*

Introduction

Financial literacy is recognised as a critical tool for promoting economic growth and development in various sectors of the economy. It has been linked to increased productivity, efficiency, and profitability among smallholder farmers who play a vital role in ensuring food security and poverty reduction in developing countries. Eswatini is a developing country that heavily relies on smallholder farming for food production and employment. Smallholder agriculture is a critical contributor to food security and poverty reduction in Eswatini, with more than 70% of the country's population relying on agriculture for their livelihoods (FAO, 2020). The farmers predominantly grow staple crops such as maize, sorghum and beans but there has been a growing interest in baby vegetable farming due to its profitability (NAMBoard, 2020). However, levels of financial literacy among smallholder farmers in Eswatini are generally low, which limits their access to finance and other support services.

This paper is a review of the effects of financial literacy on efficiency of government-supported smallholder baby vegetable farmers in Eswatini. Various financial literacy initiatives implemented in Eswatini, challenges facing smallholder farmers in accessing financial services, and the link between financial literacy and the efficiency of baby vegetable farming are examined.

Several studies have been conducted focusing on the effects of financial literacy on smallholder agriculture in developing countries. For example, Kelsall et al. (2017) argue that promoting financial literacy among smallholder farmers requires a politically informed approach that involves building coalitions for change at different levels. Similarly, Luseno et al. (2018) reviewed literature on financial literacy and agricultural development in Africa and found that it was positively associated with productivity and efficiency among smallholder farmers. Other studies have focused on the nexus between financial literacy and access to credit. For instance, Ogollah et al. (2020) observed that financial literacy significantly improved smallholder farmers' access to credit in Kenya.

In Eswatini, several financial literacy initiatives have been implemented to promote financial inclusion among smallholder farmers. For instance, the Eswatini government has implemented policies such as the Agricultural Sector Growth and Transformation Strategy (ASGTS) aimed at increasing agricultural productivity and improving the livelihoods of smallholder farmers (Eswatini Ministry of Agriculture, 2020). Moreover, the Eswatini Agricultural and Marketing Association (EAMA) provides training and support to smallholder farmers in various areas, including financial literacy. Despite all this, smallholder farmers in Eswatini still face numerous challenges in accessing financial services, including lack of finance, inadequate technical support, limited financial literacy and inadequate collateral (Mapfumo et al., 2017).

Baby vegetables, also known as micro-vegetables or specialty vegetables, are highly nutritious and are in high demand in the domestic and export markets. Smallholder baby vegetable farming in Eswatini is primarily supported by government programmes, which provide inputs, training, and market linkages to farmers (NAMBoard, 2020). However, the sector also faces several challenges, including limited access to finance and inadequate technical support.

This paper is a contribution to the existing literature on financial literacy in smallholder agriculture, focusing on the efficiency of government-supported smallholder baby vegetable farming in Eswatini. Financial literacy gaps in Eswatini's smallholder baby vegetable farming sector are identified and measures to improve financial literacy levels and enhance the

efficiency of the sector are proposed. The next section of the paper will review the literature on financial literacy in smallholder agriculture in developing countries, with a specific focus on Eswatini.

Financial Literacy and Smallholder Farming

Definition of financial literacy and its importance

Financial literacy (FL) describes an individual's ability to make financial decisions for the effective and efficient use of monetary resources (Enoila & Entebang, 2017). Potrich *et al.* (2016) concluded that financial literacy combines three components: knowledge, attitude, and behaviour. Financial knowledge, financial behaviour and financial attitude have significant influences on financial literacy (Tuffour & Amoako, 2020). Scheresberg (2013) recorded that high financial literacy enables confidence in personal financial decisions, appropriate monetary outcomes, savings, and investment instruments, as well as high-cost borrowing options. Financial literacy is an element of human capital that helps improve society members' financial welfare through employing financial services (Kozina & Ponikar, 2015). However, Lusardi & Mitchell (2014) defined financial literacy as an individuals' capacity to process and use economic information to make financial decisions, such as financial planning, financial investments, debt management, and insurance. Kreschovska (2015) added that financial literacy is composed of the ability to ensure personal income, make expenditure decisions, evaluate financial decisions for the present and future through understanding of the economics of the job market, another key component also for business management. FL builds farmer's capacity to understand, demand, practice and use financial services needed in enterprise management.

Contrary to financial inclusion (FI) which is the access and use of financial products (World bank, 2017) including affordability (UN, 2003). Related is that FL is the capacity to execute finance-related activities and decisions in everyday life (Hsiao & Tsai, 2017). The ability to save, use credit, buy insurance products, receive remittances, and make transfers and payments through bank and non-bank facilities for needed financial transactions (Canduya *et al.*, 2017; Demirgüç-Kunt *et al.* 2018). Accordingly, lack of control over future outcomes decreases with the respondents' preference for saving, investment, and risk while that financial information enables financial planning, which erodes a materialistic attitude (Rai *et al.*, 2019, Shapiro & Wu, 2011). Better use of financial services and instruments is increased with higher level of FL (Nunno & Andoh, 2011) by enabling confidence in personal financial decisions, appropriate monetary outcomes, savings and investment instruments, and high-

cost borrowing options (Scheresberg, 2013). Moreover, FL enables enterprise owners to better operate the businesses, specifically the financial decisions.

Financial literacy and smallholder farmers

Financial literacy has been adopted in policy for the growth of the agribusiness agenda in smallholder development. In Malawi, FL through imparting financial knowledge to women farmers was effective in improving farm performances through growing net returns of enterprises (Cherotich et al., 2019). Pea producers in Guatemala adopted more food safety standards towards Global Gap certification following improved individual FL levels (Muller & Theuvsen, 2015). FL aided in the translation of certification as a driver of economic benefits of pea exports. FL increased the probability of accessing to financial services by smallholder farmers improves among the FL than in the financially illiterate group in Kenya (Wachira & Kihiu, 2012), increased financial inclusion in Ugandan households (Candiya et al., 2017), while financial knowledge increased the FI levels where FL positively and significantly enabled access to financial services as well as optimised the capital structure in the in SA and UK (Ngek, 2016; Hussain et al., 2018). Loan repayments among farmers after being trained on FL (Mutegei et al., 2015; Seikei at al., 2013). In addition, Zakic et al. (2017) reported better use of financing sources and low liquidity risk in farm holding in Serbia. Increased financial knowledge on enterprise owners help lower monitoring costs, information asymmetry on loan acquisition and collateral deficiencies in firms (Hussain et al., 2018). Furthermore, increased FL levels drew more farmers into e-commerce for Agric-related purchases and payments (Su et al., 2021). koreen & Nemoto (2020) reported that while Fintech enables access to financial services and improve financial inclusion for the marginalised groups, adoption is limited by levels of financial and digital soundness in the group. As a result, making FL significant to the integration for FinTech in farming communities.

Financial literacy has also unlocked the use of financial services and the saving behaviour of agricultural enterprise owners. Nunoo & Andoh (2011) recorded that increased FL levels increased use of financial services and financial instruments in Ghana while in Bangladesh, financial knowledge greatly enhanced the access to financial services (Hasan & Hoque, 2021). Use of table banking services improves the savings rate and financial knowledge among farm enterprise owners (Cherotich et al., 2019). Therefore, increasing smallholder agricultural enterprise owner FL levels could be the solution to smallholder transformation into significant economic players.

Advantages of financial literacy in smallholder farming

Credit access improves and information asymmetry reduces as farmers gain FL (Hussain et al., 2018). Loan portfolio management (Seikei et al., 2013), informed financial decisions (Oseifah, 2010) and better bookkeeping for liquidity management (Seikei et al., 2013, Adomako & Danson, 2014; Zakic et al., 2017) is also evident with high FL levels. Increase in budgeting skills influenced growth in farm sales, profits and smoothed the enterprise operations while better adaptability to the changing business environment and use of innovative farm enterprise strategies was recorded by Oseifuah (2010) when farmer financial knowledge is increased. van Rooij *et al.*, (2009) established a positive association of financial knowledge with financial literacy, while Siswanti & Hilida (2020) found that financial knowledge significantly financial management behaviour. Informed financial decisions are resultant from sound financing, credit use and accountability of returns, as well as expenditures.

Accordingly, a farm owner/manager is not saving-oriented without financial management training and would not present better financial behaviour (Mandell & Klein, 2009; Tuong & Doan, 2020). Financial literacy improved confidence in financial decisions and appropriate financial outcomes (Kovar & Ball, 2013). Financial planning through savings and investment improves financial literacy (Tuong & Doan, 2020) yet Raoi *et al.* (2019) concluded that good financial behaviour was strongly associated with financial literacy. Therefore, achievement of the overall enterprise growth objective is also enabled through high FL levels of business owners.

Contrary, in the USA, poor FL levels limit implementation of business growth strategies in SMEs (Atkinson, 2014). The ability to make effective financial choices in financial management hinder new business development and increase SME failure rates (Kim, 2000). In addition, the execution on business functions essential for financial management is limited with low FL levels of the owners (Adomakod & Danson, 2014). Conclusively, low FK increased financial disputes that negatively impact growth of farm enterprise (Gibbon's, 2015). Improving FL levels among farm enterprise owners can contribute massively to smallholder commercialization and agribusiness development.

Efficiency in Government-Supported Smallholder Baby Vegetable Farming

Definition of efficiency

Ndayitwayeko & Korir (2012) defined the production efficiency of a farm as its ability to produce and attain the maximum output possible with a level of a given input without varying its costs for that level. Technical efficiency (TE) uses the quantity of inputs used on a unit scale against harvest while the allocative efficiency (AE) uses the budgetary allocation per

output per unit production scale (per hectare). These measures evaluate the enterprise management capacity to allocate and use resources to generate farm benefits.

Technical efficiency measures the ability of the producers to produce the highest level of output given the technology and inputs at hand (Farrell 1957; Coelli *et al*, 2005; Hong & Yabe, 2015). It is measure based on quantities of inputs used and output harvested without introducing the prices and can be classified into three components. These are the scale efficiency, congestion, and the pure technical efficiency (Farrell, 1957). Scale efficiency refers to the potential productivity gain from achieving optimal size of a farm while congestion efficiency is when the increase in some production inputs could cause output to decline (Farrell, 1957).

Allocative efficiency (AE) measures the ability to produce maximum output at the lowest cost combination possible (Farrell, 1957). Evaluating expenditure decisions on production factors, where high efficiency reflects the closeness of marginal production costs to the marginal benefit from production. Determining if respondents are producing using the best possible cost combination, through optimal allocation of the direct, operational, and overhead costs of production (Purdy & Langemeier, 2019). This is the ratio on the total actual unit cost of producing an output to the total cost of optimal factor combinations of producing the same output (Chukwuji *et al.*, 2006).

Allocative efficiency (AE) can be computed using the cost efficiency of production, revenue efficiency of production, or the combination of the two, which called the profit efficiency (PE) of production (Wu, 1996). The ration of the possible least-cost mix for the enterprise to the actual observed farm costs of production is called the cost efficiency (CE), while the ratio of the potential maximum enterprise revenue a farmer can be observed to the actual recorded in the farm is called revenue efficiency (RE). Profit efficiency, therefore, refers to the combination of the two, CE and RE. The choice of which efficiency at each time depends on the prevailing market conditions, especially the input and output prices observed (Merwe, 2012). For an industry where farmers face the same product prices but different input prices, use CE, while for the same input prices, yet different output prices use the RE. Profit efficiency will therefore be used when both input and produce prices are different.

Farrell (1957) defined economic efficiency (EE) as the product of TE and AE (see Equation 1). It is the ratio of least cost combination to the actual costs recorded in a farm enterprise. Such that.

$$EE = AE * TE \quad \text{..... equation 1}$$

Factors affecting efficiency in smallholder farming.

Efficiency could be high or low in smallholder vegetable enterprises depending on significant factors to the group location, organization, and level of modernization of farms.

High average TE (75%) was recorded in tomato enterprises in Ethiopia (Weldegiorgis *et al.*, 2018) and red onion (89%) in Sri Lanka (Atapattu & Rupasena, 2016). In Nepal and Cameroon, vegetable farms recorded moderate TE levels (62% and 67%), respectively (Akamin *et al.*, 2017; Shrestha *et al.*, 2016). A change in the share of irrigated land negatively influences TE in vegetables production. An increase beyond the average scale of production would reduce the output for this group of growers Adeoye (2020 and Rajendran *et al.* (2015). Irrigation helps in raising the resource use efficiency through increasing outputs (Li *et al.*, 2018). In Eswatini high technical efficiency levels have been recorded in irrigated vegetables (Malinga *et al.*, 2015; Kongolo, 2014). Also, water use efficiencies in dairy (Masuku *et al.*, 2014) and mushroom production (Dlamini *et al.*, 2018).

Fertilizer quantities used in production affect TE. Evident is output elasticity for tea enterprises in Vietnam (Hong & Yabe, 2015), and overuse of fertilizer in the rice production in Nigeria and needed to be reduced by 98% (Ajoma *et al.*, 2016). While seed rate significantly affected yield levels in red onions and wheat in Vietnam and Afghanistan, respectively (Atapattu & Rupasena, 2016; Tawva *et al.*, 2017). Agrochemicals have an adverse effect on tea in Vietnam (Hong & Yabe, 2017). Ajay *et al.* (2016) recorded unfavourable weather, water scarcity, pest, and diseases as limitations to TE in brinjal production in Chhattisgarh. Therefore, as Kahim *et al.*, (2021) emphasised that improved technical support improves farm input usage. Optimized use of farm input quantities enable higher technical efficiency levels in farm enterprises.

Allocative efficiency of small-scale farmers varies and so are the factors influencing it. On vegetable smallholder farms, Nepal has a mean AE level of 0.5 (Shresta *et al.*, 2015), Tzaneen, South Africa has 0.39 AE (Mokgalabone, 2015), Uganda has 75% (Okellojwabi & Mugonola, 2019) and Pakistan has (0.71) (Ahmed *et al.*, 2019). Labour, machinery and fertiliser and agrochemical costs are in excessive use in smallholder farms in Brazil, China, Pakistan, Cchattisgarh & Ukraine (Cai & Yen, 2019; Ahmed *et al.*, 2019; Ajay *et al.*, 2016). Household size, distance to market, farms size, number of crop enterprises, use of animal power and access to extension are significant socio-economic factors influenced by AE (Okellojwabi & Mugonola, 2019). Effective cost-saving technologies and production methods contribute high allocative efficiency levels in agriculture.

Lack of education, inadequate extension service and small irrigable land, age and gender of household head significantly affect EE (Degefa et al., 2019; Grebremariam et al., 2019). Higher EE is recorded with cooperative participation in Vietman (Tran et al., 2023) while in Tartastan, the use of obsolete and inefficient technologies including insolvency of small farms were factors negatively influencing EE (Battalova et al., 2019). Farmer capacity to benefit from technologies and make informed financial decisions influence economic efficiency outcomes.

Returns to scale represents efficient of use of farm capital which is presented by the sum of the coefficients of all the input costs; seeds, fertilizer, agrochemicals, and tractor (Tahir *et al.*, 2019). Improvements in smallholder farm efficiencies could be achieve by enabling farmer education, experience, extension service, optimising farm size, membership to framer groups and innovative production technologies (Plastina & Lence, 2018). However, age and distance to supplies and markets has negative implications to smallholder farms. Optimization of allocation of land, labour, fertilizer, water, and other farm resources enables the efficiency of the farm enterprise and helps on maximising the returns (Weldegiorgis *et al.*, 2018).

Government support for smallholder farmers in Eswatini

The Eswatini government drives the production system through the provision of extension, water resource development, and market coordination. Smallholder agricultural development is an initiative aligned to the NEPAD-CAADP 2014-2024 agricultural development framework (NEPAD, 2014). This framework advocates for capacity building for high resource efficiency through enabling policies and investments. CAADP also targets inclusive growth and transformation by 2025, closing yield gaps through high productivity.

The Relationship Between Financial Literacy and Efficiency

Financial literacy improved confidence in financial decision making and appropriate outcomes (Scheresberge, 2013). Hilgert & Horgath (2002) records that increased financial knowledge, attitude and experience influence financial management behaviour. Business planning enabled loan acquisition and control of variable costs (Mishira *et al.*, 2009; Ruben et al., 2019; Huang et al, 2015). A positive impact of FL on economic success of SME is record by Musie et al. (2015).

Evidence of the impact of financial literacy on efficiency in smallholder farming

Financial literacy (FL) influences the impact significance of financial resource availability required for enterprise growth (Owusu & Ismail, 2019; Bochdadi et al., 2020; Hossain, 2020). This is by ability of farm-owner to identify and adopt profitable enterprises which could be finances with most profitable financing alternatives (Ying et al., 2019; Resmi et al., 2019; Lui et al., 2020; Agyei et al., 2015; Shah et al., 2020). Owner level of FL is also positively associated with long-term small enterprise growth objective (Dieguez-Soto et al., 2021) where owner financial awareness aids in managing profit and expenses (Ying et al., 2019) while fostering risk management in the enterprise (Illmeyer et al., 2017). Business sustainability and entrepreneurial development is interconnectedness with owner FL level, extension support and financing of the enterprise (Andriamahery & Quanzzaman (2022). FL has also a positive impact on financial risk attitude and access to finance (Kuluthunga, 2019; Nohong et al., 2019; Buchdadi et al., 2020). However, finance access and financial risk attitude in SMEs mediates the effectiveness of the impact of FL on small farm's economic performance (Buchdadi et al., 2020).

Financial literacy (FL) is a direct medium for finance resource availability and finance risk attitude (Ye & Kulathunga, 2019), which is an essential trait for enterprise sustainability and growth. Financial literacy improves smallholder commercialization through enabling access to farm credit, amount of loan funds as well as global market integration (Mariyono, 2018; Ankra et al., 2020; Muller et al., 2015). Accordingly, Lui et al. (2020) concluded FL improves demand for innovation that enable management efficiency in farm enterprises. Therefore, improving financial literacy of small farm owners/managers can greatly impact the sustainability and growth of the agricultural enterprises.

Theoretical framework explaining the relationship between financial literacy and efficiency.

Figure 1 shows an integrative framework for financial literacy in SME, which better represents the application and drivers of FL in smallholder enterprise outcomes. High smallholder farmer financial literacy improves owner capacity to identify profitable opportunities, adopt risk management practices and improves risk tolerances essential for better business outcomes. Agency theory relates to the alignment of enterprise goals and decision-making capacity of the of the owner which with low FL could jeopardise the overall performance. The pecking order and trade-off theory points to low levels of FL also limits embracing the implications of external and internal finance as given by information asymmetry on decision making.

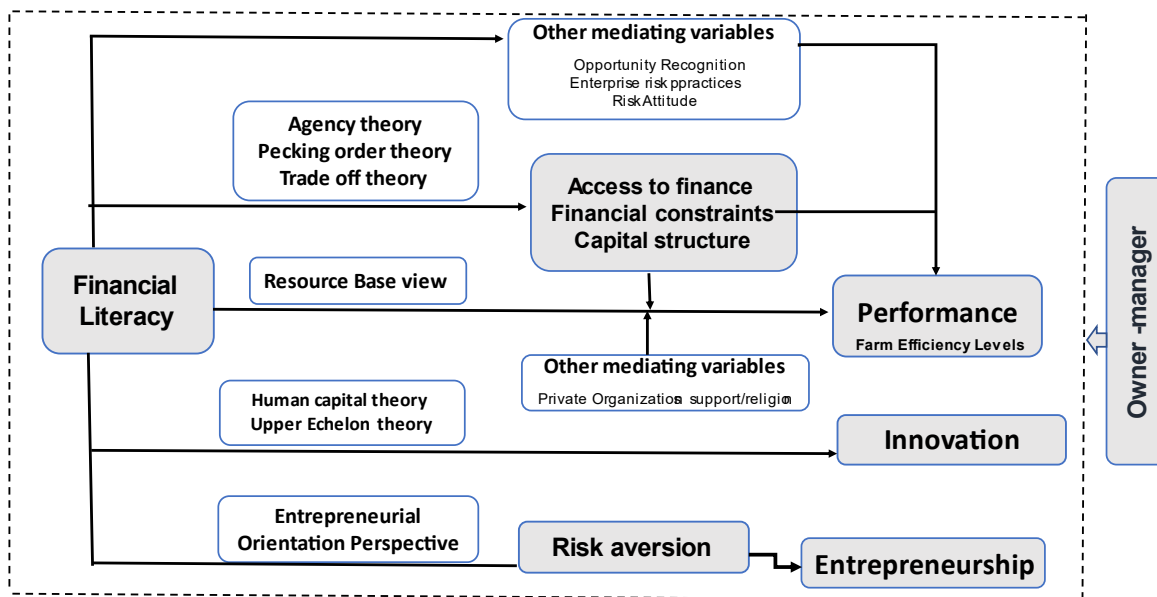


Figure 1: Integrative framework for Financial Literacy in SMEs by Molina -Garcia et al, 2022

These theories propel overcoming capital access and proper allocation in the enterprise for better returns. The optimization of benefits from both tangible and intangible farm resources is attributable to the resource-based view theory coupled with technical support and alliances that grow FL of owners also improve delivery on the profit goal.

The upper echelon theory drives the need for high FL of farm owner/managers to impact enterprise returns as emphasised by the human capital theory that building FL skills is essential for farm enterprise managers. FL skills for better efficiency drives the demand for cost-saving innovations which when combined with entrepreneurial orientation of the owner strategies permits unique flexibility that help in navigating other agricultural challenges for profitable outcomes.

Financial Literacy Training Programmes for Smallholder Farmers

Existing financial literacy training programmes in Eswatini

The National Financial Inclusion strategy 2017-2022 details financial literacy programmes that aim to build local capacity in Eswatini. These are business clinics, financial clinics, entrepreneurial analysis, and radio as well as talk shows (Government of Swaziland, 2017). These are driven as a collaborative between the Eswatini Enterprise Development

Company, Centre for Financial Inclusion, Department of Cooperative Department, Eswatini Financial Services Authority, microfinance institutions and the private commercial and development. The smallholder farmers benefit from these programmes including tailored programs in the Ministry of Agriculture under the agricultural extension department and its alliances. Farmer training programs run as short-term training that seek to enable understanding, practice as well as demand financial services essential in farm management. Intended is sustainable growth through export growth, strengthening the business environment, entrepreneurial development, and import substitution. Thereby creating decent work and economic growth for all, sustainable goal 8. The National strategic Roadmap 2019-2022 recognizes the limited focus on strategies that enhance exports and economic development within the government (ESRM, 2018). It aims to focus on private sector growth to boot outcome orientation. The target sector for economic recovery is agriculture and agro-processing, among others. The objective is inclusive growth through the facilitation of export-driven growth and smallholder farm High-value market integration. Inclusive development upholds structural transformation through enabling productive capacities, productivity, financial inclusion, sustainable agriculture and reduced inequality (UNDP, 2018).

Effectiveness of financial literacy training programmes for smallholder farmers

Improved access to financial services increases the profitability of climate smart agricultural investment and improved economic benefits of adoption of CSA practices (Ruben et al., 2019; Long et al., 2016; Nyasimi et al., 2014). FL training translates the interconnectedness of credit, savings, and insurance towards adoption of business practices (Ruben et al., 2019). High FL builds capacity for one to compare and use various financial services (Klapper & Lusardi, 2020), improves monetary benefits to the owner (Tony & Kanitha, 2020) and permits better access and inclusion into finance sector (Kodongo, 2018; Kostou et al., 2015). Thereby influencing the demand for financial services, both form and informal (Adeturij & David-West, 2019; Gill & Bhathachanya, 2017). As given in Kim & Lee (2018), high FL for short micro loan for shortage remedies dropped as savings rate improved. Instead, a higher demand for complex financial services was increased with more FL levels in India and Indonesia (Khan et al., 2021). Therefore, the contribution of FL training in smallholder farmers could build the demand and active use of financial services that allow for better business-to-business transaction for high efficiency of business.

Challenges facing financial literacy training programmes.

A moderate relation relationship between financial access and SME growth with high FL level (Ntanyi et a.l, 2017). Bylander & Phasy Res (2020) in Cambodia found that a 20-week

long SELA training program by MFI has less effect on farmer FL levels. Results show limited capacity of farmers to navigate new financial products, financial institutions and understand financier responsibilities in the enterprises. However, MFI push for debt repayment using moral messages and provided a market for financial services. As Ruben et al. (2019) concluded successful upscaling of inclusive finance depends on a nexus of finance offer, technical assistance, and business support services. Accordingly, limited financial knowledge, financial practice, and financial attitude together could undermine the effectiveness of FL benefits in the enterprises.

Conclusion

Summary of key findings

Financial literacy is an essential driver of smallholder farm enterprise performance and sustainability. FL improves financial decision making, credit evaluation and use, repayment as well as guide savings and risk management in enterprises. FL level of owner/manager is key in the realization of smallholder farm commercialization through enabling standards adoptions, financial resource access, innovation and economic returns in the sector. This can be realised by improving financial education, financial practice and financial attitude of farm owner/managers.

Implications for government-supported smallholder baby vegetable farmers in Eswatini

Financial literacy could be used as a mechanism by which smallholder access to finance and standards adoption is enabled. The practice of financial management skills and active use of formal financial services by farmers could build capacity to demand tailored financial services that better meet the financial need of these enterprises. Built farm owner/manager financial risk management skills could contribute to sustainability and growth of the enterprises, thereby increasing its contribution to export diversification.

Recommendations for future research and policy

Future research could investigate the active demand topology and use of agricultural financial services to guide on the level suitability of agricultural finance instruments. Furthermore, the extent of practise of FL skills on digital financial services by smallholder farmers as time saving platform enabling more time to be spent on the farm enterprise.

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Appendix 10 - Subject List

1. Agnes Ngozo	7623 8419
2. Dlamini Dudu	7663 3830
3. Dlamini Girly	7648 9058
4. Dlamini Mbuyazwe	7604 5909
5. Dlamini Minar	7816 9225
6. Dlamini Ntombi	7669 2512
7. Dlamini Samueli	7617 6940
8. Dlamini Sifiso	7615 9986
9. Dlamini Thabsile	7640 8716
10. Fikile Simelane	7604 8469
11. Florence Dlamini	7652 3558
12. Gama Siboniso	7648 9650
13. Gcebile Zwane	7654 7529
14. Gift Shongwe	7603 8781
15. Gule M.	7674 6896
16. Gule N.	76395943
17. Gule V.	7647 6986
18. Khanyisile Ndzimandze	7690 2188
19. Lukhele M.	7621 4770
20. Lungile Makama	7644 5790
21. Magagula Makhosazana	7653 0700
22. Make Mashigo	7624 5157
23. Makhosi Dlamini	7861 4540
24. Malindane Thwala	7608 8970

25. Mandla Msimango	7608 0314
26. Maseko M.	7624 3687
27. Masuku N.	76124539
28. Matsebula Nkosingiphile	7637 1527
29. Mavis Dlamini	7611 6407
30. Mavuso V.	7621 9212
31. Mduma	7645 4096
32. Mhlanga B.	7678 3907
33. Mohale Zama	7816 0703
34. Motsa Ester	7626 1993
35. Motsa M.	7645 6898
36. Msweli M.	7624 3681
37. Ncongwane Anna	7662 2951
38. Nokuthula Masuku	7612 4539
39. Nonhlanhla Mazibuko	7847 3631
40. Nonjola M	7690 6508
41. Nqobile Dlamini	7810 0051
42. Nqongwane A.	7662 2951
43. Peter Thobahale	7611 3091
44. Phindile Thobahale	7613 0836
45. Sandile Zwane	7889 4282
46. Sibandze Brian	7633 0505
47. Simanga Sikhondze	7614 6828
48. Simelane M.	7673 2201
49. Simelane M.	7690 4537
50. Simpiwe Mndzebele	7813 3281
51. Sindisiwe Shongwe	7603 8781

52. Sipiwe Dlamini	7636 3493
53. Sipho Ntjalintjali	7605 1009
54. Thobsile Nxumalo	7604 1394
55. Thwala Botseen	7604 6779
56. Zanele Shongwe	7604 4888
57. Zinhle Bhembe	7666 1520