BUSINESS MODELS FOR LINKING SMALLHOLDER FARMERS TO MARKETS: THE CASE OF BANANA PRODUCERS IN MERU COUNTY, KENYA

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DECLARATION AND RECOMMENDATION

Declaration

I declare that this thesis is my original work and to the best of my knowledge has not been presented for any degree at any other university.

Sign: _____ Date_____

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Recommendation

This thesis has been prepared with our supervision and submitted for examination with our approval and recommendation as the University supervisors.

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DEDICATION

To my mum Lucy and dad Joash; and to my wife Miriam and son Nkosi for their love and support.

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ABSTRACT

Recent research emphasizes adopting business models that not only improve market linkages but also enable inclusion of smallholder farmers in high value markets along the value chains. While evidence points to positive impact of business models choice, studies seldom exploit the extent of their impact on smallholder gross income. Besides, socioeconomic and institutional factors associated with such choice of the models are discussed incoherently, hence less understood. The objectives of this study were: to identify and characterize various business models used by banana farmers to link with other value chain players; to determine the socioeconomic factors that influence the choice of business models by the farmer and to investigate the effect of business models on the gross margin of farmers participating in the value chain. In this study, a multistage sampling technique and systematic sampling was conducted and 146 banana farmers in Meru County sampled. An assumption was made that there was mutual exclusivity in choice of a business model. Broadly, three categories were identified: buyer-driven, producer-driven and intermediary-driven business models. Farmers who chose buyer-driven models were more likely to link to markets through processors, exporters, retailers and often engaged in contract marketing. They were motivated by higher price, provision for farm input, increased profits and market availability to their produce. Those in producer-driven models exploited collective action in farmer groups and co-operatives including sharecropping. Farmers who chose intermediary-driven models were more likely to engage in joint ventures with traders, wholesalers, NGOs and Government. Multinomial logit results showed that sex, age, education level, group membership, income and having someone to initiate the market linkage process positively influenced choice of the business model. Smallholders (79.45%) realized a gross margin of below USD 200 per month. This high-resolution evidence of how socioeconomic and institutional factors affect choice of business model and the consequent influence impact of the model on gross margin can inform researchers and policy-makers on best approaches to use in linking smallholders to markets.

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LIST OF ACRONYMS AND ABBREVIATIONS

AERC	African Economic Research Consortium
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GM	Gross Margin
GOK	Government of Kenya
GVCs	Global Value Chains
HCDA	Horticultural Crop Development Authority
KALRO	Kenya Agricultural and Livestock Research Organization
KDLC	Kenya Development Learning Centre
SDGs	Sustainable Development Goals
NGOs	Non-governmental Organizations
RBV	Resource-Based View
FAO	Food and Agriculture Organization of the United Nations

CHAPTER ONE
INTRODUCTION

1.1 Background

Smallholder farmers in the Sub-Saharan Africa supply above 80 per cent of the food for household consumption and markets (Samans, Blanke, Corrigan and Drzeniek, 2015). Specifically, in Kenya (a low-middle-income country), it is reported that 70 per cent of the rural population depend on agriculture and 65 per cent of exports earnings are from the agricultural practices (IFAD, 2015). There are two major sectors of agriculture: livestock rearing and crop farming in Kenya. Major crops grown include coffee, tea, sugarcane and horticultural crops for local consumption and export. Recently, horticultural farming has increased and crops such as banana, passion fruits, tomatoes, mangoes, French beans and other vegetables have started earning farmers a lot of income (Mbuva, 2015). This sub-sector has a wide array of production, socio-economic and geographic diversity. Besides, there is still need for accessing high value markets. The development of high value markets along the value chain presents horticultural smallholder farmers with better opportunities to earn more income. These opportunities are because of globalization and well-designed market arrangements.

1.1.1 Banana Marketing in Meru

Banana (*Musa spp.*), is a local staple diet as well as an export crop. In Kenya, there has been an increase in banana production from 1,394,412 tonnes in 2012 to 1,398,154 tonnes in 2013 (FAO, 2015). As an export crop, banana is exported to United States and European markets where it is consumed as green, ripe or value-added banana flours. In 2013 alone, 20 metric tonnes of banana were exported, valued at 30,000 US$ (*ibid*). In Meru County, banana is sold in the form of green bunches, banana flour and ripened banana (HCDA, 2015). Banana is viewed as a pro-poor enterprise (Place *et al.,* 2009). As such, its role in poverty eradication cannot be ignored. Currently, the banana market is growing. This is due to increasing demand and emergence of large retail markets in the country. Additionally, important marketing arrangements and strategies such as market contracts, crop insurance, vertical and horizontal integration that farmers can benefit from have provided better incomes for smallholder banana farmers in Meru and continue to grow.

Further, the regulatory role played by Horticultural Crops Development Authority (HCDA) and the innovation platforms designed by the Kenyan government and NGOs has boosted

marketing efforts in Meru. As such, there have been calls for expanding production levels and engagement of stakeholders in marketing banana along the value chain. Therefore, this study presents the case of banana marketing in Meru County to analyse whether business models that are implemented through various marketing arrangements improve the smallholder banana farmers' income and incentivise them to join high value markets.

1.1.2 Business models for linking smallholders to high value markets

In order to increase earning opportunities, there are calls for smallholders to embrace the appropriate business models. A business model is a high-level conceptual description of not only how farmers can create products that meet customers' needs or capture value but also design chain of activities that are geared towards linking them to value chain players and other market agents (Kimble, 2015). Business models provide new exploratory ways to overcome marketing puzzles by combining institutional economics theories with entrepreneurship. Besides, the initial conclusions that institutional approaches could single-handedly solve marketing initiatives has become widely regarded as implausible due to the interplay between different marketing systems (Schneider and Nega, 2016; Dehejia, 2015).
Business models, for example, contract farming have been shown to lead to better market access, credit access and access to inputs (Elepu and Nalukenge, 2009). Other studies have argued that business models provide assurance for sale of farm produce with larger agribusiness firms that offer better prices and incentives (Setboonsarng, 2008). Furthermore, these guaranteed price premiums help smallholder banana farmers with potential to exploit the opportunities that large retail markets are offering. This study analyses the various business models and their impact on smallholders' gross margin and bases the arguments on a game theory-type approach.

1.2 Statement of the Problem

Smallholder banana farmers still face challenges such as high transaction costs, exclusion from high value markets, information asymmetry and non-enforcement of marketing contracts among others along the value chain. This is further complicated by high poverty levels among farmers that force them to sell in typical spot markets that fetch low prices. Banana farming is ideal for transforming the rural livelihoods and may reduce unemployment among youths and women. To deal with such challenges, appropriate business models have been proposed and promoted by government and non-government organizations in different platforms. While evidence points to positive impact of sound business model adoption, the types of business models used, the socio-economic factors influencing their choices as well as

effect of such business models on smallholder banana farmers' gross margins is not clear. Besides, the theoretical underpinnings and scarce literature on business models present the need for further inquiry into their effect on smallholder banana marketing in Meru County.

1.3 Objectives

The broad objective of the study was to contribute to improved market access by smallholder banana farmers using appropriate business models in Meru County.

The specific objectives included:

i. To identify and characterize business models used by banana smallholder farmers to link with other value-chain players.
ii. To determine the socio-economic factors that influence the choice of a business model by the farmer.
iii. To investigate the effects of business models on the gross margin of farmers participating in the value chain.

1.4. Research Questions

i. What business models do the smallholder banana farmers use in their effort to link with other value-chain players?
ii. Which socio-economic factors influence the choice of a business model by the farmer?
iii. What is the effect of business models on the gross margin of farmers participating along the value chain?

1.5 Justification of the study

New business models that can facilitate smallholder farmers' integration along the value chain are likely to positively affect their incomes. Appropriate choice of a business model will help link the farmers to high value markets thereby increasing incomes and making better their livelihoods. The findings of this study will assist smallholder farmers to choose the most appropriate models to link them to the markets. The business models characterization is guided by farmer and farm characteristics and will inform policy makers on the most appropriate platforms to address the banana marketing challenges that smallholders face. In addition, understanding the behavioural relations and the socio-economic issues surrounding the linkage and stable matching of smallholders to different market agents is important for addressing market linkage issues. This is because such understanding can reveal ways to improve the efficiency along the value chain and designing of business models that serve the interest of smallholder farmers and the market agents.

Therefore, this study adds to the body of knowledge on business models and proposes new theories that may interest future research.

1.6 Scope and Limitations of the Study

This study covered smallholder banana farmers in Meru County who practice banana farming. The study used cross-sectional data collected in 2014 under CIAT. The sample consisted of 146 households that grew and sold banana in Meru County between 2013 and 2014. Business model approach was used to model market access issues based on famers' socio-economic characteristics. Besides, the study included a proposal of game theory-type approach in explaining these models benefit to the understanding of market access problems.

The findings of the study are applied to the smallholder banana farmers in Meru County and may not reflect the opinions of all banana farmers in Kenya. However, insights derived from this study may inform the nature of banana trade elsewhere in Sub Sahara Africa where smallholder characteristics are almost similar. Furthermore, due to climate related factors, seasonality and agronomic factors related to banana production, the study required use of longitudinal data. This may limit generalizations to a particular region and time.

1.7 Definition of Terms

Business models: The architecture of revenue within a farm; also referred to as a high-level conceptual description of not only how farmers or traders can create products that meet customers' needs or capture value but also design chain of activities that are geared towards linking them to value chain players and other market agents (Al-Debei and Avison, 2010).

Horticulture: The science and art of growing fruits, vegetables, flowers, or ornamental plants.

Market linkages: It is the physical or financial bundling of two or more services offered by sub-market(s) to form a single service or related services (Kelly, 2011).

Value-chain: High-level model of how businesses receive raw materials as input, add value to the raw materials through various processes, and sell finished products to customers (Vermeulen and Cotula, 2010).

Smallholder: It is used here as a broad equivalent to family farmer, and captures the huge diversity of farming systems where agricultural activities are mainly based on family labour (FAO, 2014).

Upstream and downstream market links: It is an inclusive expression for the set of business opportunities, beyond direct agricultural production, that exist for large-scale agribusinesses, smallholder farmers and small local enterprises (Shuen *et al.*, 2014).

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter introduces the concept of business model, its origin, typology, application to horticultural practices and gives insights on the literature gaps that need to be addressed. Besides, the chapter provides theoretical arguments that underpin the approach chosen in this study. This is extended to the conceptualization of the business model and its linkages to other socio-economic factors.

2.1.1 The Concept of Business Model

The business model concept became prominent in the late twentieth century (Boons and Lüdeke-Freund, 2013). Over the years, this concept has been widely applied in strategic management discipline (Teece, 2010), and has spread to other disciplines (Blackwell and Eppler, 2014). Its foundation lies in economics, on issues such as what strategic assets and conditions are required to achieve Ricardian rent, or quasi-rent, transaction costs economics, imperfect tradability, *ex-post* and *ex-ante* barriers to entry and imitation and substitutability of farm produce (Zott and Amit, 2013). Numerous definitions of business models have been proposed, with some being abstract (Al-Debei and Avison, 2010), whilst others are detailed and descriptive of the business functions (Osterwalder *et al.*, 2011). Research in the field of business models has mostly focused on e-Business (Krumeich *et al.*, 2012). Due to such focus, its applicability in agriculture has been constrained by theory-based approaches, rather than field-based observations (Dottore, 2009).

Besides, due to such minimal applicability and limited research, business models are often confused with concepts like business modelling which depicts the essence of the business (George, 2011). Business modelling gives the user a clear understanding of the business logic underlying the entity's existence (Osterwalder and Pigneur, 2011). It is also different from strategy as Casadesus-Masanell and Ricart (2010), state that, "business models are attributed to replications of the realized strategy." Therefore, strategy shapes the development of capabilities that can alter current business models in the future. Strategy is about building dynamic capabilities aimed at responding efficiently to future and existing contingencies. Nevertheless, business models are important in providing information that reflects the economic and strategic choices that have been made by individuals and firms.

2.2 Types of Business Models in Agriculture

There are different types of business models applicable to smallholder agriculture. Vermeulen and Cotula (2010), define business models for agricultural investment as "the way in which a company (in this case smallholder farmers' businesses) structure their resources, external players and customers in order to create and capture value." To create and capture value, farmers choose from a variety of business models. Such choices among different business models, however, do not add up to a simple "yes/no" answers or based on the strengths and weaknesses of one business model to the other. This is because the models overlap and can be combined into various hybrids. Categorization of business models to capture the overlapped and hybridized business models is therefore important. The most prominent categories and types of business models include producer-driven business models, buyer-driven business models and intermediary-driven business models. Producer-driven business models are based principally on finding where to supply and the need for reducing costs (Bishop *et al*., 2009, Torero, 2011); and builds on community goodwill (Birthal, 2015). These business models, however, are predisposed to cultural barriers or institutional flaws that may dent the prospective of market-based approaches (*ibid*).

In buyer-driven business models, the consumer/buyers influence how it operates. Value proposition and value addition practices are encouraged such as proper labelling, low cost practices and rigorous standardization. Since buyer-driven business models are market-based mechanisms, regulatory capacity (value chain governance) is likely to be weak (Elbehri, 2013; Garnevska *et al.*, 2011). There is rare allotment of externality cost between consumer and buyer since the buyer totally disregards the cost a producer incurs to offer the value they want. Finally, NGOs and governments prefer intermediary-driven business models because they provide opportunity for partnerships and linkages with technology, service and input providers (Bishop *et al*., 2009). However, they are prone to manipulation by intermediaries. Table 1 below summarizes the types of business models for linking farmers to markets and for linking them with other value chain players.

Table 1: Types of Business Model.

Type of Business Model	Driver	Objective
Producer-driven	Smallholder producers Large scale producers	• New Markets • High Market prices • Stabilize market position
Buyer-driven	Processors Exporters Retailers	• Assured Supply
Intermediary-driven	Traders, wholesalers, NGOs and Governments	• Supply to customers, regional development

Source: Vorley *et al.* (2008).

2.2.1 Business Models: A Game Theory Approach

Business models that are adopted by smallholders in their marketing efforts need understanding of the "rules of the game" along the value chain. This is because these rules define whether there will be conflict or cooperation between the marketing agents who are assumed intelligent and rational decision-makers (Knox-Hayes, 2009). Therefore, discussing business models by evaluating the transitive preferences of the agents may reveal their true motive for preferring to be matched with one farmer and not the other. This study proposed that stable matching of marketing agents is only possible through designing of a game-theory-type approach. Thus, following the arguments of Roth (2002), the first proposition of this study was that business models could facilitate smallholder integration into value chains through inter-firm cooperation and vertical and horizontal integration. This followed an understanding of behavioural relations of the agents along the value chain. Furthermore, such behavioural relations, if well designed, were assumed to lead to better matching of agents and farmers, hence higher income among the linked farmers in the market.

The second proposition was that these behavioural relations and understanding of the rules governing integration would lead to stable matching of preferences of value chain players. This provided a better way of circumventing market inefficiency that other studies have identified (Fama and French, 2008). To get a stable matching between smallholder farmers and value chain agents, the study assumed complete and transitive preferences of the value

chain agents as alluded to earlier. The stable matching of these agents increases the acceptability of smallholder farmers along the value chain because the 'crisis of confidence' especially among buyers of the banana product is minimized (ibid). Thirdly, the study suggested that socio-economic factors such as age, education level, sex among others influence the business model choices, thus affects the stable matching of the agents. Therefore, the study assumes that algorithms that produce stable matching in the market are only achievable hypothetically and no single theory can explain all market issues (Roth, 2002).

Other studies have also identified game theory approach to be suitable for understanding why linkage of farmers to high value markets may be cumbersome. In agriculture, high value markets provide farmers with both risks and opportunities. While studying agricultural investments in Indonesia, Tambunan (2014) identified numerous business models and concluded that risks and stable matching of value chain partners provide mixed results that needed further enquiry. In fact, Okeleke, Lucini and Hatt (2015) also identified problems of mismatch. The authors contended that poor matching of chain partners and poor business models are highly associated with productivity losses, supply chain inefficiencies and farmers' financial exclusion and access problems. Such information needed thorough analysis to find out models that could minimize ambiguities in matching farmers to the right chain partner.

Additionally, understanding the behavioural relations so that a stable matching of value chain players can be achieved has been proposed. For example, it was reported that Malawi rice farmers were in a worse situation despite existence of a large number of rice millers ready to buy their produce (Itai, 2015). This meant that market inefficiency existed and value chain partners were not properly matched. The author further contended that marketing arrangements and poor business models further hindered market linkage efforts. The study also revealed that finding the right partners for contractual arrangements and vertical and horizontal integration proved futile for some smallholders. In other studies, the argument was that even if partners were found, there often arose instability in such partnerships due to various issues such as side selling, side-buying and dishonouring of contracts (Pan, 2015). Studies by Roth, Sonmez, and Unver (2007); Abdulkadiroglu and Sonmez (2003); Roth (2002) and Roth and Marilda (1989), have provided theoretical and empirical insights on how matching of agents in a market place can be modelled. Thus, this study relied on such a *priori* knowledge to develop theoretical underpinnings of the game theory-type approach used

hereby. Even though most of these studies seldom addressed farming practices and particularly in the Sub-Saharan Africa context, they still provided real life situations where such game theory could succeed. They had been successful in school admission programs and kidney exchange programs among others (Roth, 2002).

2.2.2 Empirical Studies on Business Models in the Horticultural Sector

Understanding the behavioural and preferential treatments of market agents along the value chain as highlighted above has received some appreciation in horticultural literature as well. Particularly, adopting a given business model and not the other to reveal the true motives behind selling arrangements that farmers prefer has been looked into. Studies reveal that business models in horticultural sector are adopted in single form or hybrid form (Nalla and Kouwenhoven, 2015). A study on adoption of business models by smallholder farmers in Indonesia identified hybrid forms such as contract farming, especially plasma and nucleus system, as the most popular form of business models (Tambuman (2014). The study further argued that partnerships as a business model failed to make local farmers better off. In a different study, marketing pre-arrangement as a model was contended to lead to market access and commercialization of smallholder farmers expressly for high-value crops, such as horticultural crops by stipulating terms and conditions of the agreement (Elepu and Nalukenge, 2009). Campbell *et al*. (2012), while studying agricultural practices and business models in Laos identified issues such as land lease or ownership as leading causes to business model failures.

The other business models in horticulture apart from contract farming include group-managed models. Group managed models were associated with improved social capital and collective action among smallholder farmers (Kinyua, 2008). These were mainly producer-driven business models. The author noted that such models could be pragmatic in marketing banana. Karani-Gichimu (2013), suggested co-operation among smallholder farmers for promotion of cross-border farmer linkages to markets and for tapping the economic potential from banana. Joint farming as a business model also can questionably help absentee landholders and farmers with smaller plots to come together and exploit thrifts of large-scale farming (FAO, 2012a).

Since contract farming seems to be the most preferred business model by the farmers, rigorous theoretical review and econometric analysis has been done (Mwambi *et al.,* 2013; Tambuman 2014; Vermeulen and Cotula, 2010). Contract farming refers to a system where a

central processing or exporting unit purchases the harvests of independent farmers and the purchase are arranged in advance through contract (Chakrabarty, 2015; Mansur *et al.*, 2009). Types of contract farming include centralized model, nucleus estate model, multipartite model, informal model and intermediary model. The Centralized model represents a vertical coordination where the sponsor purchases the crop from farmers and processors and/or packages them then markets the products. Mostly, farmer quotas are normally distributed at the beginning of each growing season and quality is tightly controlled (Chakrabarty, 2015). The nucleus estate model is a variation of the centralized model. The sponsor of the project also owns and manages an estate plantation, which is usually close to the processing plant (Word Bank, 2010). Besides, the estate is often large to guarantee constant supply of the product (Holmes, 2012).

The Multipartite Model usually involves statutory bodies and private companies jointly participating with farmers (Chakrabarty, 2015). Multipartite contract farming may have separate organizations responsible for credit provision, production, management, and processing and marketing (World Bank, 2014). This arrangement is popular in Mexico, Kenya and West Africa, whereby governments act jointly through vertical integration approach (Holmes, 2012). The informal model applies to individual entrepreneurs or small companies that normally make simple, informal production contracts with farmers on a seasonal basis, particularly for crops such as fresh vegetables, watermelons and tropical fruits (Sokchea and Culas, 2015). The intermediary (tripartite) model is popular in Southeast Asia where formal linkages with farmers to intermediaries is practicable (Holmes, 2012). This model is also characterized by the possibility of danger that the sponsor may lose control of production and quality as well as prices received by farmers (Ramsundar and Shubhabrata, 2015).

2.3.3 Socio-Economic Factors Influencing Business Model Adoption

Identifying the appropriate rules governing value chain players' behaviours is important. These behaviours are shaped by the socio-economic and institutional factors that shape choice. This study attributed such behaviours to the nature of competitiveness in horticultural sector. Competitiveness reveals the socio-economic and behavioural factors that push farmers towards choice of business models (Ferris *et al.,* 2014). Studies by Njuguna *et al.* (2014), as well as Okwoche *et al.* (2012) have delved into socio-economic factors in horticultural sector. In particular, the studies found that economic related factors such as the size of investment and access to credit have high influence on a farmer's capacity to adopt a business model.

Besides, Kalahan (2013) and Panda (2008), found that farmers' experience have effect on farm and business success. However, Hannah and Mullainathan (2013), argued that experience does not necessarily positively impact marketing success. Different studies conducted by Mussa (2014) and Indarti and Langenverg (2008), found that education has positive effect on farm business success. Taking a different perspective, Hannah and Mullainathan (2013), argued that people with more education are not necessarily more likely to be entrepreneurial. Group membership and cooperatives membership can influence participation along the value chain by smallholders as noted in a study of onions, leeks and tomato production in Madagascar (Bellemare, 2011).

Sserwanga and Rooks (2014), found that age and support networks have positive contributions in business. However, a study by Rose *et al.* (2006), found that the business success can also depend on skills, and training too. Government also plays a significant socio-economic role in bridging gap between private and public partners. For example, Ferris *et al.* (2014), Ramsundar, and Shubhabrata (2015), found that farmers get support services from the public or private agencies thus may realize significant rise in sales, employment and productivity.

2.2.4 Effect of Business Models on Income

Having a stable matching by designing appropriate "rules of the game" along the value chain is important. Identifying behavioural relations, institutional factors and socio-economic factors behind such rules is more important. However, identifying the income model that maximizes the matched agents' incomes is the most fundamental constituent in the business model design (Osterwalder, 2011). This study uses Gross Margin analysis to reveal the impact of business models on smallholder farmers' income. Gross margin analysis is one way of exploring whether intervention measures, aimed at delivering resource poor smallholder and low income earning farmers from poverty influence development. Klippenstine (2014), argued that gross margin is important in determining whether the business model would be profitable to a smallholder farmer. The author further argued that by deducting the variable input costs for producing a single crop from the gross revenue that a selling arrangement results into is the most versatile tool to measure profitability of a venture. It should be noted that most studies have used either gross margin analysis or income analysis to determine the profitability of farming (Birachi *et al.,* 2013; Zulu, 2011).

For example, a study on impact of contract farming as a business model in Cambodia used income analysis to identify important role it plays in determining development path (Sokchea and Culas, 2015). In addition, in a review of crop selection and sustainable farming based on

contractual arrangement of smallholder farmers with Walmart, the authors proposed an income analysis and concluded that there can be up to 10-15 percent increase in income if business models are facilitated by sound marketing arrangements (Clinton and Whisnant, 2014). However, in a different study of smallholder avocado farmers in Kandara district of Kenya, contract farming was found not to necessarily result in improved household income (Mwambi *et al.,* 2013). Additionally, support services were suggested to corroborate household welfare and income. There are, nevertheless, contentions that the perceived increased income from contract farming reduces uncertainty and minimize risk for smallholder farmers due to stabilized income flow as in deeper analysis of Agriculture and Resource Management Survey (ARMS) data from China (Xiaoxue *et al.,* 2015).

In terms of household welfare, a report by GIZ (2011) indicated that better income could trigger self-supporting, pro-poor business models that can promote better household choices and decisions. Such pro-poor business models not only facilitate faster decision making but also offer avenues for exploiting marketing opportunities amid high production and transaction costs of inclusion into value chain (Tawney *et al.,* 2015).

While some types of business models have been linked to farmer exploitation that negatively impact income through agricultural brokers' association as indicated by Shudon (2008), there are some models that better the incomes of farmers. A study on marketing contracts as a business model in Ethiopia identified income from brokerage to cover up-to about half of the annual household expenditures (Haji, 2010). Another example is the successful business partnership that started in 1992 linking cocoa farmers in West Africa and chocolate lovers in the UK and USA (World Vision, 2012). This has seen extensive agricultural and technical advice and training that improve crops and hence influence positively on smallholder farmers' income (*ibid*). In a separate study, disparity in income was observed between contracted farmers at Reasmey Stung Sen Agricultural Development Cooperative in Cambodia. Those linked to markets through good business models had positive impact on their income (Sokchea and Culas, 2015).

Bellemare (2011), indicated that business model such as contract farming can have positive impact on farmers' income, however, lack of a clear definition of 'disadvantaged producers and workers' based on access to markets as well as income is contended issue for the contracting parties, the risk is more one of paternalism and dependence. On the other hand, a case study analysis by Berdeguéet *et al.* (2008), found that opportunistic behaviours direct economic impact on income. Buyers are quick to criticise 'side-selling', but may readily engage in 'side-buying', procuring opportunistically outside (*ibid*).

2.2.5 Market Governance Structures

As identified above, income from farming therefore depends on the value chain integrators' institutions that govern how they conduct their business. Integrating smallholder farmers especially using the market-based business models calls for market governance. Market governance determines the forms of regulation and incentive schemes that are beneficial to members in the various marketing and service transactions. Improved market governance is helpful in building resilience and for achieving sustainable agriculture for global stability and food security especially among the rural smallholder farmers (Aderibigbe, 2013). Governance structures, in hybrid forms include bilateral contracts (classical, neo-classical and relational contract arrangements), networks (collective trading, partnership) and alliances (cooperatives, join venture) (Pascucci, 2010). These modes of transaction arrangements incorporate a full range of governance structures that can be ranked along the continuum between arms-length arrangements and full integration (Menard, 2012). The most common market governance structures include spot market, bilateral and farmers' associations. The governance structures are discussed in details as below.

Spot market is characterised by informal relationships between sellers and buyers and the transaction is done on the spot with most likely unrepeated relationship between the parties (Furubotn and Richter, 2010). The other type of governance structure is relational-based. It is based on relation and previous experiences between buyer-seller (Van Kranenburg *et al.*, 2014). It is classified under bilateral form of governance structure (Pascucci, 2010) and raises the issue of trust in the transaction. Several authors see trust as a way to secure transactions when contracts are incomplete (Weseena *et al.*, 2014).Farmers' association as a governance structure implies group membership to provide most needed assistance through monitoring, grouped selling, assisting members in finding markets, and social assistances. This form of governance is characterised by long term contracts, it generally lasts as long as your membership of the association is still valid (FAO, 2014).

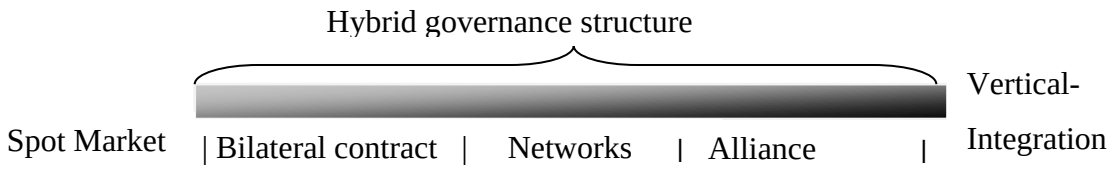


Figure 1: Continuum of governance structures in the chain.

Source: Adapted from Pascucci, (2010).

2.3 Theoretical and Conceptual Framework

2.3.1 Theoretical Framework

Zott and Amit (2013), in their review of business model literature, argued that there is no single applicable theoretical framework for analysing business models, but recommended integration of various theoretical frameworks for examining the value creation potential of the firm's business model. There may be minimal a *priori* reason to doubt such assumptions but recently, a fundamental theorem has emerged. The game theory-related approaches developed by Roth (2002) seem too appealing and provided new perspectives into the business model theory and market access puzzle. Thus, in this study, it was argued that the simple conceptual models of market dynamics that had been in use to give theoretical insights seem too implausible to explain the working of markets in today's complex markets. To harmonize this information gap, the study modifies the Matching Theorem developed by Roth (2002) and integrates the widely accepted Dynamic Capabilities Theory by Ritthiphruk and Salgado (2012) to explain how smallholder farmers can be first linked to high value markets, then matched with value chain players and reaps much from farming. However, it should not be noted that resolving most information paradoxes lack nor have findings of flawed assumptions (Stephen Hawkins *et al.,* 2016). For possible other theories that can explain business model concept, Table 2 provides a summary.

2.3.2 Dynamic Capabilities View

The theory posits that possessing superior resources or competences can allow supra-normal returns in the short term (Ricardian rent), but in order to earn entrepreneurial (Schumpeterian) rents, a farmer needs the ability to create, alter, combine and re-combine their strategic assets: dynamic capabilities and innovativeness (Malone *et al.,* 2014). Thus, a business model needs to be based on dynamic view that can help a farmer to strategize. According to this theory, farmers need to adopt strategic management in high-innovation and high-velocity markets. (Teece, 2014). Dynamic capability is very relevant in explaining participation in high-velocity markets like the banana market in Meru (Shuen *et al.,* 2014). Thus, the perspective of looking at business model as a *process* and not a *static* issue can solve the dynamism required for farmers to participate in high value chains (Amit, 2014). The flaw of this theory is that it is rarely applicable in agriculture and may not explain much of the dynamics of agricultural commodity markets.

2.3.3 The Matching Markets Model: A Game Theory Approach

Following Roth (2002, 2008), this study modified the matching model to model the smallholder farmers' quest for inclusion into high value markets. It should be worth noting that this is a new theory developed through analysis of related theories.

First, let there be a disjoint arrangement of marketing agents and farmers, $F = \{f_1, ..., f_n\}$ and $W = \{w_1, ..., w_n\}$. Each farmer is in need of accessing at least one high value market. However, each high value market/agent f_1 seeks (up to) q_1 farmers. A matching is hereby defined as a subset of $F \times W$, which forms the set of matched pairs. It is assumed that a farmer can only be linked to one market agent at time t_1 (for example harvesting period), thus the farmer appears in no more than one pair at that period. Consequently, any marketing firm f_1 appears in no more than q_i pairs at the same period. A matching is therefore only identified with a correspondence $\mu : F \cup W \to F \cup W = \{x \mid x \in F / x \in W\}$ such that $\mu(W) = f$ and $w \in \mu(f)$ if and only if *(f, w) is* a matched pair. However, if no matched pair contains, then $\mu(w) = w$ (meaning that if a farmer is not matched to a given agent, he/she is automatically matched to himself/herself).

Let it further be assumed that agents have complete and transitive preferences over the "acceptable" farmer they want to buy his/her banana. The agents further prefer not to remain unmatched (or leaving a position empty) and may not wish to be left for the post-match farmers called "the scramble." The preferences of a farmer w_1 are therefore given by $P(w_1) = f_1, f_2, ...,$. This indicates that the farmer's preference for the agents is f_1 to $f_2 \left[f_1 >_{w_1} f_2 \right]$ (agent f_1 is strictly preferred by farmer w_1 to agent f_2.

It is known that an agent needs a group of farmers to link with and the agents' preferences for farmers is $P(f_1) = \{w_1, w_2, ...w_k\}$. This agent does not exploit the list yet. Thus, it can be concluded that an agent's preference for a given farmer is "responsive" to that farmer's preference.

Lemma: $S \subset W$ with $|s < q_1|$ and any farmer w and w' in W/S, $S \cup w >_{f_1} S \cup w'$ if and only if $w >_{f_1} w'$, and $S \cup w >_{f_1} S$ if and only if w is acceptable to f_1 (proof of strict preferences among agents).

The case presented above means that there could exist a rejection of a farmer such that the agents *block* the matching. This case has rarely been understood in the market linkage context and this theory explains what is highly likely to take place in the real markets of Africa. In summary, a matching *x* is stable if and only if the agents do not block farmers from joining their high value markets. Thus, for a matching to be stable, preferences should be responsive, the set of stable matching should be equal to the core (which is usually defined by weak domination) of the game whose rules state that any farmer and agent may trade, if and only if their preferences are responsive and they mutually both agree.

The Case of a Large Market

Following Kojima, Parag and Roth (2013), this study took the case of large random markets to represent the case of smallholder farmers. The fact that a stable matching may not necessarily exist in a finite matching market presented a case to consider an alternative random market. It is argued that a random market is a tuple $\prod = (F, W \geq_H, \kappa, \mathrm{P}, \rho)$ where F is the set of market agents, W is the set of farmers, k is appositive integer, $P = (P_f)_{f \in F}$ is a probability distribution on F and ρ is a function which maps preferences. In general step $t \leq k$: an agent is selected randomly from a distribution P until an agent previously not drawn from steps 1 through t-1 is drawn. Thus, the agent is listed as the t^{th} most preferred agent of a single farmer w. This is the case for matching a single farmer to a single market agent. It then follows that if a single farmer's preference w, whereby $(w \in W)$ for a single agent k is transitive, complete and "responsive," then the other agents will be unacceptable. Likewise, each market agent has a responsive that it defines over a set of farmers $\geq f$ such that almost all the presented farmers become acceptable to such agent. It naturally follows that the preference list-capacity pair that will be consistent with $\geq f$ is (R_f, k_f).

The case presented above is a model that can achieve a "win-win" for both market agent and farmers. Thus, this study tried to present a valid a *priori* reason to doubt most of the classical `unquestionable' assumptions about market access with regard to the dynamism that surround horticultural markets in Africa.

Table 2: Other Relevant Theories that Explain Business Models.

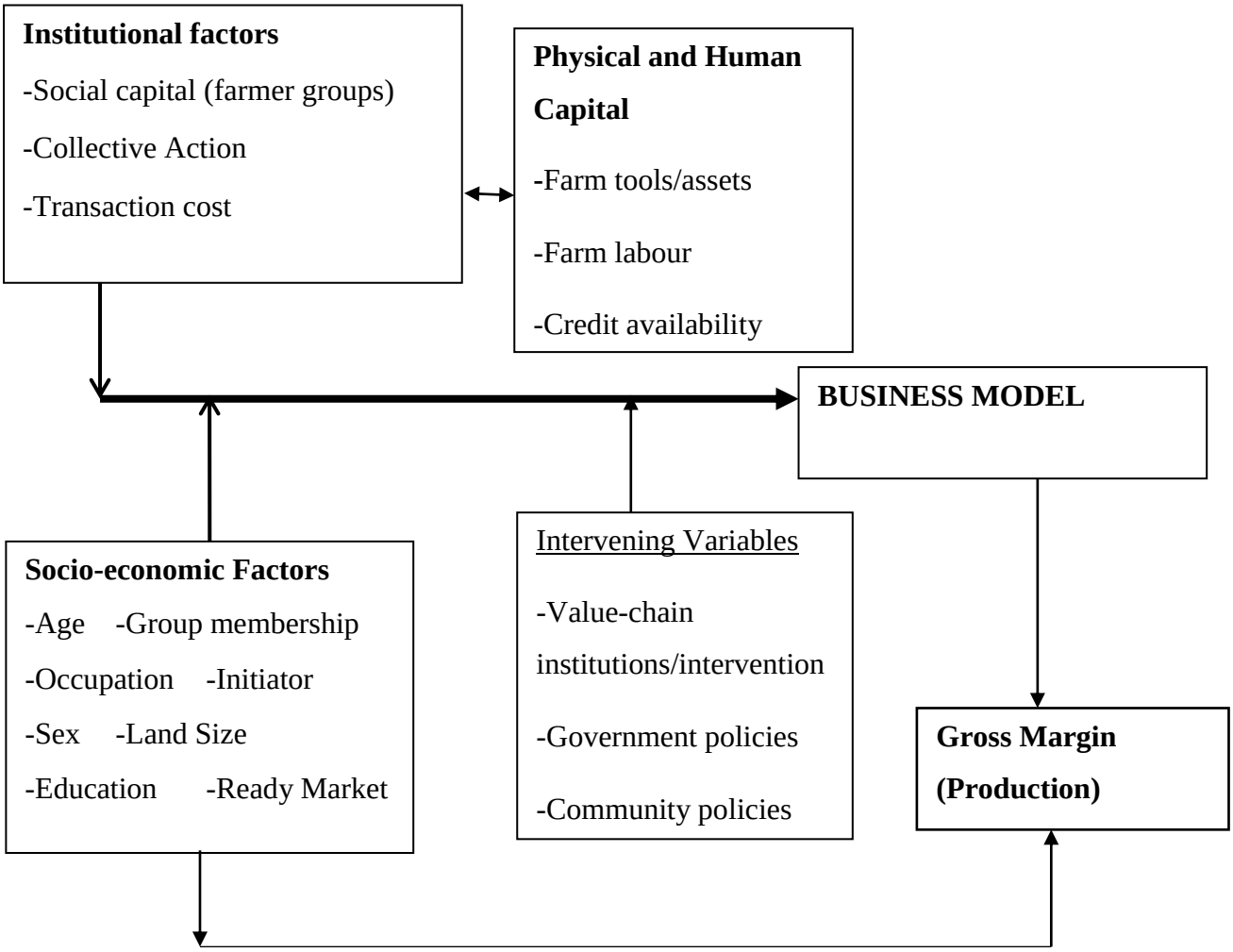
Functions of the business model	Relevant Theories	Implications
Value proposition	Resource-Based View	Offering based on value derived from strategic assets / core competences
	Relational view/ appropriability regime	Value proposition designed to avoid appropriability problems
Market segment and revenue model	Resource-Based View	Market segment chosen follows the value proposition to gain maximum value from strategic assets
	Relational view	Revenue model designed to gain economic share of relational rents
Value chain	Transaction cost economics	Optimise level of vertical integration
	Resource-Based View	Identify need for complementary assets
	Value chain analysis	Comparative efficiency of individual Activities
Value network	Transaction Cost economics	Cost and risk reasons for alliance formation
	Resource Based View	Access complementary assets
	Dynamic capabilities	Adjust (build/acquire) internal and external competences to dynamic environments'
	Absorptive capacity	Increases capacity of the firm to gain from alliances

Source: Summary of Rasmussen's Framework (2007).

2.3.3 Conceptual Framework

Figure 2 below represents interrelations of socioeconomic and institutional factors, their influence on choice of a business model and extent to which such models determine the farmers' gross margin. In this study, business models are presented as market linkage and access tools. This study proposes that for farmers to be linked with other value chain players, or be matched to the right ones as discussed in the proposed theory above, their "responsiveness" to accept a given business model need to be considered. However, in choice, certain constraints that include social, economic and institutional factors occur. Business models that generically induce variables are count in nature. The non-negative integer values {0, 1, 2, 3 ...} of such counts provide a flexibility within the model discussed above to respond to changes in tastes and preferences over years.

The business model therefore responds to changing socioeconomic factors such as age, sex, level of education among others. The dynamism in the market discussed above and the need for matching smallholder farmers to responsive agents provides a leeway for intervention. Thus, the intervening variables such as government policy and value chain players' own preferences for farmers to link within their value chain determine the course a farmer's choice given his/her social, economic and institutional status. The consequence of a responsive matching guided by a sound business model therefore is associated with higher incomes. If it were to be presented along indifference curve, a right shift would be appropriate.



Note: ——→ Indicates direction of influence.

Figure 2: Interrelationship of Factors Influencing Choice of Business Models

Source: Own Conceptualization.

CHAPTER THREE:
RESEARCH METHODOLOGY

3.1 Area of Study

The study was conducted in Meru County, specifically in Imenti South. The county is located in the. Eastern province of Kenya and shares common borders with Laikipia to the West, Nyeri to the South West, Tharaka/Nithi to the East and Isiolo to the North. The county has a total area of 6,936.2 Km^2 out of which 1,776.1 $Km^2$is gazetted forest (Meru County Government, 2014). It straddles the equator lying within 00 6' North and about 00 1' South, and latitudes 370 West and 380 East.

Ecologically, the County has varied ecological zones ranging from upper highlands, lower highlands, upper midlands and lower midlands that have significantly influenced the major economic activities. The 7 upper highlands zones covers majority of the county's area ranging from Imenti South, Imenti Central, Imenti North, Tigania East, Tigania West, Igembe North, Igembe Central and Igembe South constituencies. The lower midland zones are only found in lower parts of Buuri and Tigania which borders Isiolo County. The County receives moderate amounts of rainfall except for the lower parts of Buuri area bordering Isiolo County which are arid. The distribution of rainfall ranges from 300mm per annum in the lower midlands in the North to 2500mm per annum in the South East. Other areas receive on average 1250mm of rainfall annually. There are two seasons with the long rains occurring from mid-March to May and short rains from October to December. Temperatures range from a low of 8^oC to a high of 32^oC during the cold and hot seasons, respectively. The plateau terrain in the County allows easier construction of infrastructure such as roads and the use of modern farming machinery.

Nine administrative sub-counties are equivalent to the constituencies. The number of wards in each constituency is included in brackets. The constituencies are: Tigania East (5 wards) Tigania West (5 wards), Igembe North (5 wards), Igembe South (5 wards), North Imenti (5 wards), South Imenti (6 wards), Buuri (5 wards), Igembe Central (5 wards) and Central Imenti (4 wards).

Demographically, the County has a population growth rate of 2.1 per cent. The 2012-projected population of the county stood at 1,443,555, which consist of 713,801 males and 729,754 females (KNBS, 2009). Agricultural and economic activities in Imenti South are practiced because there is favourable rainfall, and high altitude coupled with volcanic soils

has encouraged agricultural activities in this area. On the cooler parts, there are large tea plantations, and wheat farms in the areas of Timau, Ngusishi and the regions around the Mount Kenya. Dairy farming is also practised. On the lower slopes, that are warmer, extensive farming of banana practised. These are highly commercialized and famous throughout the country. In areas like Igoji and Ntima farmers grow ground nuts, maize and beans. The other parts like Kiirua and larger parts of Buuri constituency are known for Irish potato farming (Mwenda, 2009).

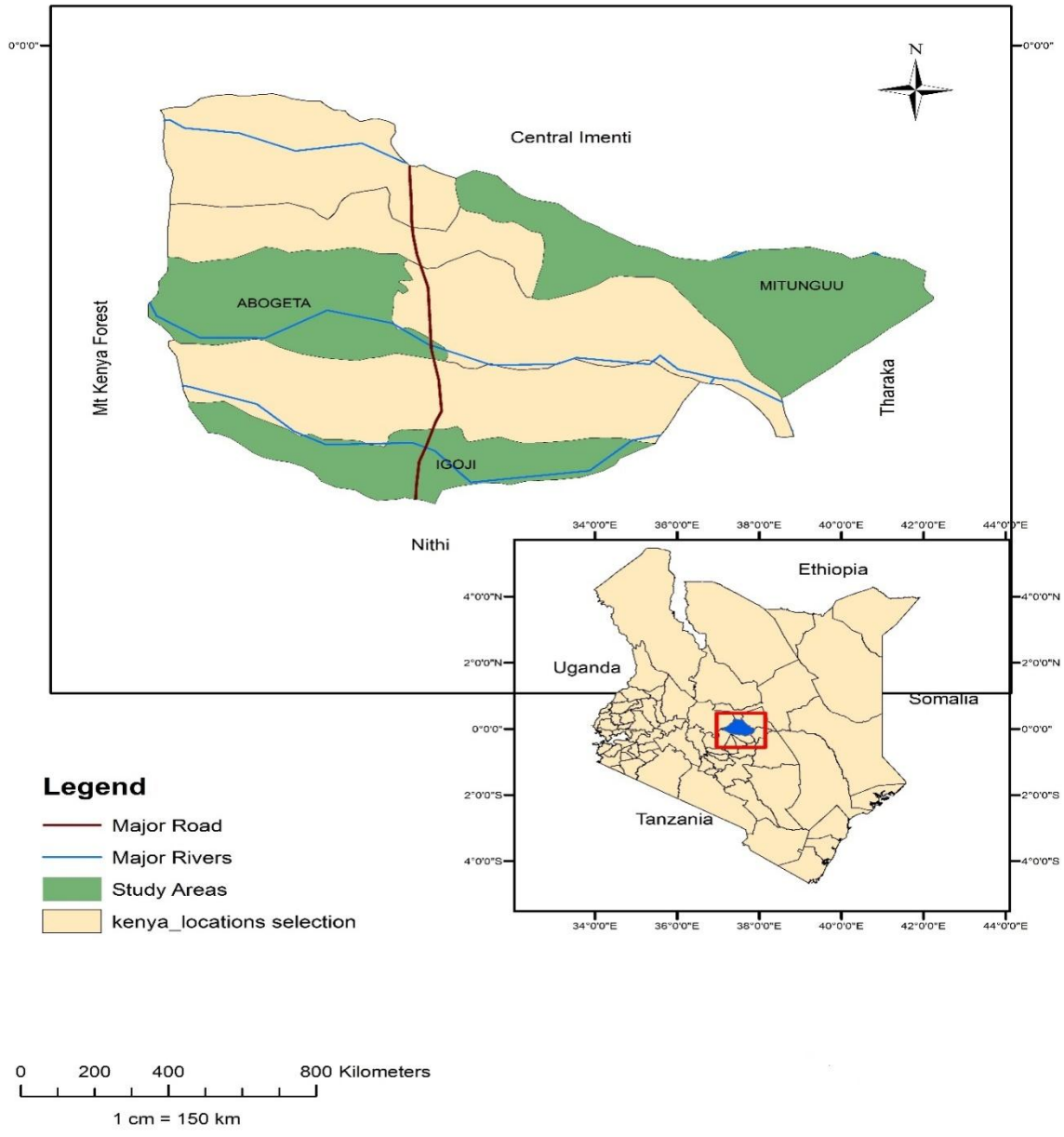


Figure 3: Map of the Area of Study.

Source: County Government of Meru (2015).

3.2 Sampling Design

The survey utilized a multistage sampling design to get 146 smallholder banana farmers in Meru County. In the first stage, Meru County was purposively selected because that is where most banana producers are found. Purposive sampling ensured that certain important segments of the target population were represented and allowed selection of rich information that provided insight into the issues of central importance to the research (Chipeta *et al.,* 2014). Secondly, out of nine sub Counties two Sub-Counties were selected randomly. These were Imenti South and Tigania West. In the third stage, Mitunguu,Abogeta East and Igoji East wards were selected through random sampling. To achieve the representative samples from banana farmers cum traders in the population, a list was obtained from respective sub-county agricultural officers. Then a systematic sampling was to select the individual farmers.

3.3. Sample size

The target population consisted of banana farmers in Meru County. The sample size was determined using World Food Program formula given below:

$$\text{Sample size} = \frac{rd(1-rd)\,popsize}{rd(1-rd) + ((ME/c)^2\,(popsize-1)}$$

Source: World Food Program, (2015).

Where:

Sample size = the sample size required for the desired margin of error and population size.

c = the standard normal deviate at the required confidence level Z score (95% = 1.96).

popsize = the size of the population of interest.

ME = the desired margin of error (2.5% = 0.025).

rd = response distribution (50% = 0.5).

In this study, a total sample of 146 producers of banana was considered.

3.4 Data Collection

The dataset used in this study was collected in 2014 and it contains the crop of interest: banana. Computer Assisted Personal Interviewing (CAPI) was used in the data collection process using CSpro software. CAPI is a set of survey technologies favoured due to its

electronic nature and can fit in modern platforms such as tablets, smartphones, mobile phones or computers (Schuster and Brito, 2011). In order to reduce the data management cost and to assist in monitoring of the survey and feedback to interviewers, CAPI was implemented just like in the case of Moldovan Labour Force Survey (Böhme and Stöhr, 2012). With assistance from highly trained agricultural extension officers, the data was collected using a questionnaire programmed in CSpro 6 software during the months of November and December, 2014. The interviewers were introduced to questionnaires and trained to operate the software. To improve on questionnaire validity and content in tangent with study objectives, pretesting was done to reduce the scope of error.

3.4.1 Type of data collected

Since the interest is to identify the choice of business models and their adoption in response to changing competitive field and globalization, the major variables in this study are the type of business model adopted, marketing intermediaries, selling arrangements, marketing costs and farm and farmer characteristics. These activities are not mutually exclusive since each household may choose one, or a number of business models and in various combinations or hybrids. Other variables on which the data was collected were on production (number of bunches of banana handled), purchase and selling arrangements, problems of banana marketing as well as the performance of business models. Data on physical capital included number of vehicles, wheelbarrow, house structure (residential and commercial), sewing machine; pump for irrigation, jembes, pangas, ox plough and knapsack among others. The total number of agricultural social groups measures social capital that a given household is a member of. The demographic data collected include household size, age, occupation and the highest education level achieved by any household member.

3.5 Data Analysis

3.5.1 Business models used by the smallholder farmers

To find out the business models used by the smallholder farmers to link with other value-chain players, descriptive statistics such as percentages, frequencies and means was used. Both measures of central tendency and measure of spread were applied. It also involved categorization, ordering and summary of the variables for quick view and analysis. The results were then visualized using appropriate info-graphics, tabular presentations and summary statistics.

3.5.2 Socio-economic factors that influence the choice of a business model

Multinomial logistic regression analysis was used to determine the socio-economic factors that influence the choice of a business model. The multinomial (Polytomous) logistic regression model is an extension of the binomial logistic regression model (Rusiman and Shafi, 2015). It is used when dependent variable has more than two nominal or unordered categories. Like binary logistic regression, multinomial logistic regression uses maximum likelihood estimation to evaluate the probability of categorical membership. Ojo *et al.* (2013) used the model for analysing the factors that affected enterprise choices among yam and cassava farmers in Nigeria. Besides, Arinloye *et al.* (2012), employed multivariate probit model in a study of 219 pineapple farmers in Southern Benin involved in out-grower schemes. Madhu *et al.* (2014) and Hegre (2014) argued that the advantages of using multinomial regression model include: robustness to violations of assumptions of multivariate normality and equal variance and co-variance matrices across groups, ease of interpretation of logistic regression results, non-assumption of a linearity between regressor and regressand, independent variables need not be interval and the model does not require that the independents be unbounded and lastly normally distributed error terms are not assumed.

The multinomial logistic regression can be specified as follows:

Suppose that there are *k* categorical outcomes and—without loss of generality—let the base outcome be 1. The probability that the response for the j^{th} observation is equal to the i^{th} outcome is:

$$p_{ij} = p_r\left(y_j = i\right) = \begin{cases} \dfrac{1}{1+\sum_{m=2}^{k}\exp\left(x_j\beta_m\right)}, if\ i=1 \\ \dfrac{\exp\left(x_j\beta_i\right)}{1+\sum_{m=2}^{k}\exp\left(x_j\beta_m\right)}, if\ i>1 \end{cases} \quad \text{---------- (1)}$$

Where X_j is the row vector of observed values of the independent variables for the $j^{t=h}$ observation and β_m is the coefficient vector for outcome *m.*

To model the business models widely used in marketing of banana, *k-1* log odds of each category in the unordered response variable was estimated. The business model categories include: buyer-driven model, producer-driven model and intermediary-driven model. The variable for the reference was chosen through "treatment contrast" instead of Helmert contrast since the latter is highly complicated. Pairwise post-hoc tests were used for comparisons within each possible pair of categories (Mitchell and Rodger, 2012). The functional form of the multinomial logistic regression model is shown in Equation 2 below:

$$\log \frac{p_r(y=j)}{p_r(y=j')} = \alpha + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_k x_k \quad \text{---------- (2)}$$

Where: P_r is the probability of choosing *y, j* is the dependent variable, j' is the reference category; α is a constant parameter, β_1 to β_k be the corresponding parameter estimates of the regressors and χ_1 to χ_k be the regressors**.** The model of socio-economic factors and behaviours among the different business model choices can therefore be represented using four (j -1) logit models as follows:

$$\log \frac{P_r(y=j)}{P_r(y=j^{'}} = \alpha + \beta_1 Age + \beta_2 Edu + \beta_3 Gen + \beta_4 Hh + \beta_5 Initiator + \beta_6 Fgrp + \beta_7 Mktaccess + \beta_8 AvgYrs + \beta_9 QntySold + \beta_{10} Farmsize \quad \text{---------- (3)}$$

Whereby: p_r is the probability of choosing/adopting a business model, α is the constant term. Parameters β_1 to β_{10} are the co-efficients of regressors. **Age**-is the age of the respondent.

Edu-is the education level which is a dummy: 0 for no education and 1 for education; **Gen**-is the respondents' sex which is also a dummy: 0 male and 1 female; **Hh**-is the size of household of the respondent; **Occ**-is the occupation of the respondent; **Fgrp**-is the mean of the number of farm groups the respondent belongs to; **Sellar**-is the selling arrangement most preferred by the respondents';**Mktaccess**-is the measure of whether a farmer accessed banana market or not; **AvgYrs**-Average Years in banana production; **Farmsize**-average farm size in acres and **Qntysold** is the quantity sold in the years 2013/2014.

Table 3: Socio-Economic and Institutional Variables and Expected Signs.

Dependent Variable	Independent variables	Expected sign	Description of relationship
Business Models (Unordered categories)	Age	(+)	Experience in production and marketing is expected to translate to higher income
Buyer-driven	Education level:	(+)	Knowledge and skills in
Producer-driven	Primary,		production and marketing is
Intermediary-driven	Secondary and		expected to positively influence
	Tertiary		income
	Sex	(+/-)	Males are expected to have better
	(1=male,		access to production and
	0=female)		marketing business models
	Initiator	(+)	Having an initiator of a selling arrangement is expected to positively influence adoption of business models.
	Belonging to a group	(+)	Membership to a group is associated with knowledge sharing that can influence business model choice
	Ready market	(+)	This may reduce opportunistic behavior and benefit farmers through increased income
	Total Cost	(+)	Higher costs were expected to influence choice
	Average Years	(+)	More experienced banana farmers are expected to make better choices
	Land size	(+)	Farmers with larger farms were expected to choose better

3.5.3 Effect of Business Model on Gross Margins of Smallholder Banana Farmers in Meru

To determine whether the choice of a business model affects smallholder's income, the study employed Gross Margin Analysis and Quantile regression to determine the significance of such effect. Gross Margin Analysis has been applied by other studies such as Birachi *et al.* (2013) in analysing factors influencing the economic benefit and costs associated with bean production in Eastern Congo. In addition, Ordinary Least Square analysis was used to assess the factors that affect gross margins and production costs. Besides, Zulu (2011) used the model to determine the main factors that affect profitability of pulses in Zambia. However, this study has moved further and instead of using the OLS, Quantile regression is used. Quantile regression has recently developed as one of the versatile models that provides conditional quantiles of the dependent variable Y given independent value of X. This allows for estimation of the upper or lower tails of the conditional distribution (Jung, Lee and MacEachern, 2014). This median regression usually tries to find line through the data with the aim of minimizing the sum of the absolute residuals as opposed to the sum of the squares of the residuals minimized in the ordinary regression (Cameron and Trivedi, 2010). Besides, the model provides an alternative way of dealing with heteroscedasticity unlike traditional OLS because it is robust against heteroscedasticity thus remove the need for transformation (Bandyopadhyay and Younas, 2015).

Even though the most appropriate method due to randomness of business model adoption would have been Difference-in Difference Model (DD), there were limitations that could hinder achievement of objectives. First, the data was cross sectional, therefore the historical nature required by such model (panel data) was lacking. Carletto, Kilic and Kirk (2009) employed DD Model, to determine the impact of adoption/choice of adoption pathways on Guatemalan smallholder households. Some authors have always preferred before and after treatments. It should be noted that such methods have been criticized for lack of control for transitory effects which normally produce biased estimates (Hausman and Kuersteiner, 2004). Other studies of market participation and its impact on household income such as Mwambi *et al.* (2009) have employed Propensity Score Matching. This was another appropriate model for this study. However, the model requires a treatment group that was lacking in the data. Besides, the model usually requires that selection be based on observable characteristics and the researcher observe all the variables that are influencing the treatment assignment.

Model Specification

$$GM = TR - TVC \text{ ---------- (4)}$$

Where GM is the average Gross Margin, TR is the average monthly Total Revenue of the Farmer and TVC is the average monthly Total Variable Cost.

Second step involved the influence of Business Models (categorical variable) and selected variables on income. The model was specified as follows:

$$Y_i = \beta_0 + \beta_1 x_1 + \beta_2 + ... + \beta_p x_{pj} + \varepsilon_j \text{ ---------- (5)}$$

This is the conventional multiple regression model with $x_1 - x_{pj}$ independent variables. However, the case presented above is for a categorical variable of Business Model with three categories that are: buyer-driven model category, producer-driven model category and intermediary-driven model category. This required special coding with identification of base category with p-1 dummy regressors.

Thus, in the third step, the models were specified as follows:

$$Y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \gamma_1 D_1 + \gamma_1 D_2 + \varepsilon \text{ ---------- (6)}$$

For Intermediary driven model ($D_{i1} = 0$ and $D_{i2} = 0$)

$$Y_1 = \alpha + \beta_i x_{i1} + \beta_i x_{i2} + \gamma_1 .0 + \gamma_2 .0 + \varepsilon_1 \text{ ---------- (7)}$$

$$= \alpha + \beta_i x_{i1} + \beta_i x_{i2} + \varepsilon_1$$

For producer-driven model ($D_{i1} = 1$ and $D_{i2} = 0$)

$$Y_1 = \alpha + \beta_i x_{i1} + \beta_i x_{i2} + \gamma_1 .1 + \gamma_2 .0 + \varepsilon_1 \text{ ---------- (8)}$$

$$= (\alpha + \gamma_1) + \beta_i x_{i1} + \beta_i x_{i2} + \varepsilon_1$$

For Buyer-driven model ($D_{i1} = 1$ and $D_{i2} = 1$)

$$Y_1 = \alpha + \beta_i x_{i1} + \beta_i x_{i2} + \gamma_1 .0 + \gamma_2 .1 + \varepsilon_1 \text{ ---------- (9)}$$

$$= (\alpha + \gamma_2) + \beta_i x_{i1} + \beta_i x_{i2} + \varepsilon_1$$

Empirical model

$$GM = \alpha + \beta_1 EDUC + \beta_2 LnMonthly\_Sales + \beta_3 LndSiz + \beta_3 AgeSq + \gamma_1 IB\_MODEL2 + \gamma_1 IB\_MODEL3 + \varepsilon \text{ --(10)}$$

Where GM is the Gross Margin, EDUC is the level of education, LnMonthly_Sales is the natural logarithm of average monthly sales of the farmer, LndSiz is the average land size under banana IB_MODEL_2 and IB_MODEL_3 are the dummies for business model. Age

squared is used for linearity issues and for the description of monotonic relationship with a single point of inflection. It should be noted that Business Model is a categorical discrete variable that needs to be recoded as a dummy variable. The dummies are IB_MODEL_2 (producer-driven) and IB_MODEL_3 (intermediary-driven) and the reference category IB_MODEL_1 is the buyer-driven category.

A set of *k-1* functionally independent linear combinations was generated.

Table 4: Summary of the Description of Variables Used in Multiple Regression Analysis

Dependent Variable	**Independent Variables**	**Sign**	**Description of relationship**
Gross Margin			
	Educational level	(+)	Knowledge and skills in production and marketing is expected to positively influence the GM
	Land size (Acres)	(+)	Smallholders with large acres of land are highly likely to have a higher GM
	Average Monthly sales (KES)	(+)	Higher sales per month is highly likely to contribute to higher GM
	Average Price (KES)	(+/-)	Average prices fluctuate thus any sign was expected.
	Business Model (Dummy Variable) _IB_MODEL_3 _IB_MODEL_2	(+/-)	Adopting a given business model in comparison to the reference category was expected to lead to either higher or lower gross margin.
	Age (Years)	(+/-)	Older smallholders were expected to have investable wealth thus better GMs than young people.

CHAPTER FOUR
RESULTS AND DISCUSSIONS

4.1 Socio-Economic Characteristics of the Respondents

This section seeks to provide the demographic as well as the socio-economic characteristics of smallholder banana farmers in Meru County. It provides an introduction for characterization of business models that smallholder banana farmers in Meru use.

4.1.1 Socio-economic Characteristics of the Households

The study analysed 146 smallholder banana farmers. In terms of sex representativeness, male farmers were 51% whereas the female farmers were 49% as indicated in Table 5. This means that sex was almost balanced and the usual skewness towards males was not observed. This finding was supported by lack of significance of the variable sex given by the Pearson chi^2 (44) = 38.2539. This is perhaps attributed to the sex affirmative action and awareness campaigns that have seen women become more productive and engaged in agricultural activities especially in Eastern and Central Kenya. Njenga reported similar results, Mugo and Opiyo (2013), who argued that there are shifting patterns of economic relations especially within the rural areas of Kenya where women have been actively increasing their participation in agribusiness and are becoming breadwinners and even household heads.

In terms of age structure, the youngest farmer was 20 years old and the oldest was 82 years. The mean age was 45 years. This means that most of smallholder farmers who produced and sold banana were in their most productive age. This was in line with previous studies such as Feyrer (2007) who contended that the most productive groups of workers (in this case farmer) were those aged between 40 to 49 years. Similarly, Lambert and Ozioma (2011) reached the same conclusions.

Community interactions and institutional frameworks were represented by membership to a group. This was to reveal whether the smallholder farmers interacted among themselves and even at the value chain level. In terms of group membership, only 29.4% of the banana farmers belonged to groups while 70.55% of the smallholder banana farmers did not belong to any group. In determining the relationship between group membership and choice of business model, the results found a significant relationship at 5% level ($p<0.01$). This may be explained by the fact that there was utilization of the social capital among the banana farmers. This finding is contrary to other studies such as Tambunan (2012) who argued that that

farmers lacked co-operation among themselves and thus blocked themselves from exploiting the benefits of collective action.

In terms of education levels, study results indicate that 2.73% of the respondents had no formal education; 60.27% had primary education, 36.30% had secondary education and only 0.68% with tertiary education. The variable education was significant at 10% in relation to the choice of a given business model. This is attributed to the fact that education helps in making better choices and decisions about market linkages and business models to use. Besides, educated household heads are expected to better comprehend the benefits of business models. This finding concurs with that of Dhillon and Singh (2006) who studied contract farming for tomato grower in India. They concluded that higher levels of education often led to better adoption of contract farming.

In selling arrangements, there may exist initiators to link farmers with agents along the value chain. An initiator was the one who started marketing arrangements such as contract marketing. Results showed that having an initiator apart from the farmer himself was important in adopting a business model. This was significant at 1%, 5% and 10% ($p<0.0001$) in relation to business models. This could be explained by the fact that initiators had better match preferences of market agents with those of farmers to identify the stable matching of such agents. In addition, the cases of self-initiated linkages would be attributed to farmers' own preferences for spot markets or lack of initiators in a given locality. Minten, Reardon and Vandeplas (2009) identified the role that having an initiator plays. Specifically, the authors identified credit and insurance marketers to initiate market linkages that influenced the functioning of supply chain.

Most of the smallholders (76%) were 55 years and below. This variable was not significant meaning that age had nothing to do with choosing business models.

Table 5: Results for Group Membership, Sex, Age, Education Level of Banana Farmers

Variable	Category	Buyer-driven	Producer-driven	Intermediary-driven	Total counts	Pearson's Chi^2	Significance
Group membership	No (29.4%)	53	40	10			
	Yes (70.55%)	28	8	7	146	6.261**	0.044
Sex	Male (51%)	44	25	5			
	Female (49%)	37	23	12	146	3.632	0.163
Education	None (2.73%)	3	0	1			
	Primary (60.27%)	43	38	7			
	Secondary (36.30%)	34	10	9			
	Tertiary (0.68%)	1	0	0	146	14.544**	0.024
Initiator	Farmer (83.56%)	73	34	15			
	Farmer group (6.6%)	5	2	2			
	Buyer (0.68%)	1	0	0			
	Government (9.59%)	2	12	0	146	25.004***	0.002
Age Category	Youths (39.04%)	35	18	4			
	Middle-aged (46.58%)	36	23	9			
	Retired (14.38%)	11	7	4	146	3.1049	0.796

*Significance at 1%***, 5%** and 10%*; LR Chi^2 (44) =38.2539

4.1.2 Results for the Socio-economic Characteristics of Banana Farmers (Continuous Variables)

Table 6 presents results for quantitative socio-economic variables with respect to the three categories of business models. Household size was found to average 5 people. This indicates that families consisted of a married couple and at least three children in cases where the marriage institution was established. However, the smaller household sizes may be attributed to family planning practices embraced by people from Eastern part of Kenya as shown by KNBS (2009) statistics. Other studies have reported 5 members per households of smallholder farmers and have further attributed household size to provision of labour (Okoye, 1999).The average experience, measured in average years a farmer has practiced banana farming was 10 years. This was significant at 10% in relation to the three categories of the business models. This may be attributed to the fact that the more experienced a farmer, the more likely he/she is to understand of the banana value chain and market agents better. This, therefore, translates to better information access along the value chain as well as well-established market linkages. Tiongco et al. (2009) who found that pig farmers who were more experienced were highly likely to be involved in contract marketing based on such experiences have reported similar findings.

The study found that 32.88% had one or 0.4047 Ha acre despite the fact that some farmers had as low as 0.125 acres. On average, the banana farmers had 0.961 acres across the adopters of the three categories of business models. Land size was significant at 10% ($p<0.01$) in relation to the categories of business models. This can be explained by the fact land ownership significantly influence whether a farmer will be involved along the value chain as a central supplier or producer. Farmers with smaller parcels are more likely to be excluded from being central suppliers. Smaller farms are also more likely to be fragmented even further due to generational inheritances in Africa. Other studies such as Miyata *et al.* (2009) revealed that smallholder farmers indeed have smaller, sub-divided lands that do not necessarily provide them with advantages along the value chain. On average, smallholders in Meru County produced 8344.783 Kgs of banana between 2013 and 2014 per farmer. Banana production was significant at 10% meaning that it influenced the choice of a business model. This meant that the average amount of banana produced by a farmer influenced his/her linkage along the value chain. Higher production may provide the farmer with opportunities for being a central supplier in a market and may influence other agents to identify such farmer for supply purpose chain.

Table 6: Socioeconomic Characteristics of Banana Farmers (Continuous Variables)

BUSINESS MODEL		Buyer-driven		Producer-driven		Intermediary-driven			Total = 100%
		55.48%		32.88%		11.64%			
	Unit	Mean	Std. dev	Mean	Std. dev	Mean	Std. dev	Average	F-test
Household Size	Number	4.691	2.004	4.542	1.320	4.706	2.392	4.646	0.260
Average Years in banana production	Years	11.000	7.362	9.042	6.185	11.471	6.709	10.504	0.018*
Farm size	Acres	0.999	0.714	0.981	0.732	0.902	0.720	0.961	0.091*
Banana production (2013/2014)	Kg	10529.630	10595.340	6680.792	11247.350	7823.529	6211.736	8344.783	0.284
Quantity sold (2013/2014)	Kg	957.531	675.653	863.750	605.920	706.471	390.464	842.58	0.603

Significance at 1%, 5%** and 10%*

While framing the appropriate strategies for smallholder inclusiveness along the banana value chains, Kenya Development Learning Centre (KDLC) (2010) found that fruits and vegetable farmers who produced more often landed opportunities of being involved in contractual arrangements with exporters or processing firm.

4.1.3 Characterization of Business Models in Meru County

The study identified three categories of business models. These were: buyer-driven models, producer-driven models and Intermediary-driven models. They were characterized in terms of their popularity and typology and then how the socio-economic factors affect them was discussed. First, buyer-driven model was the most common business model being used by 55.48 percent of the smallholder farmers. Buyer-driven models are characterized by demand from large retail firms and distributors who recruit smallholder farmers as their suppliers. Furthermore, there are contractual arrangement and vertical integration to create constant supplies for these industries. This calls for value addition and strict standards and competition in the market that may crowd out potential producer-suppliers. Producer-driven models were practised by 32.88 percent of the smallholder banana farmers in Meru. Social interactions and groups characterize it; where farmers exploit their social capital. Furthermore, it is characterized by provision of credit, inputs and market for the members. It is also characterized by better decisions that ensure that member contributions are well managed. Intermediary-driven models were least preferred by only 11.64 percent of the smallholder farmers in Meru County. Intermediary-driven model was characterized by government and NGO initiatives that drive farmer to add value to their products and link them to potential buyers.

In terms of typology, results showed that buyer driven models had other sub-categories. These included integration with processors, exporters, retailers and contract marketing as shown in Table 7. Smallholder producers and large-scale producers. Intermediary-driven model had private traders, NGOs and Governments. This typology was consistent with business models literature. For example, the typology provided by Vorley *et al.* (2008) is very similar to these results.

Table 7: Types of Business models in Meru County Smallholder

Business Model	Share-cropping	Joint venture	Processors Exporters Retailers	Contract marketing	Cooperatives & Farmer groups	Traders, wholesalers, NGOs and Government	Total
Buyer-driven			21	60			81
Producer-driven	4				44		48
Intermediary-driven		2				15	17
Total	4	2	21	60	44	15	146

4.2 Selling Arrangements for Banana in Meru County

Figure 4 below represents the findings of the selling arrangement that most smallholder farmers in Meru County preferred. It emerged that 46 percent of smallholder banana farmers preferred to sell through the brokers, whereas 40 percent preferred spot markets. This means that most farmers prefer a buyer-driven business model. The explanation behind preference for brokers and spot markets may be due to offering of instant cash on delivery, or in the case of brokers, they pick banana from farm gate thus relieving the farmer from other transaction costs. Besides, the buyer-driven model presented farmers with opportunities to sell their banana through retailers, branded marketers, branded manufacturers and organization into large suppliers. The results are similar to that of Carriquiry and Bruce (2004) who argued that the role of spot markets is to complement the contract production. Therefore, spot market and brokerage would go hand-in-hand to supplement the farmers' income in case there was low price in either spot market or contractual arrangement.

This case also provided insights for re-visitation of the concept of matching farmers to specific market agents such as retailer or wholesalers. It meant that most farmers are rarely in a stable relationship with the buyer of banana products. Therefore, this formed the basis from critically evaluating buyer-driven model and its welfare impacts on a smallholder banana farmer.

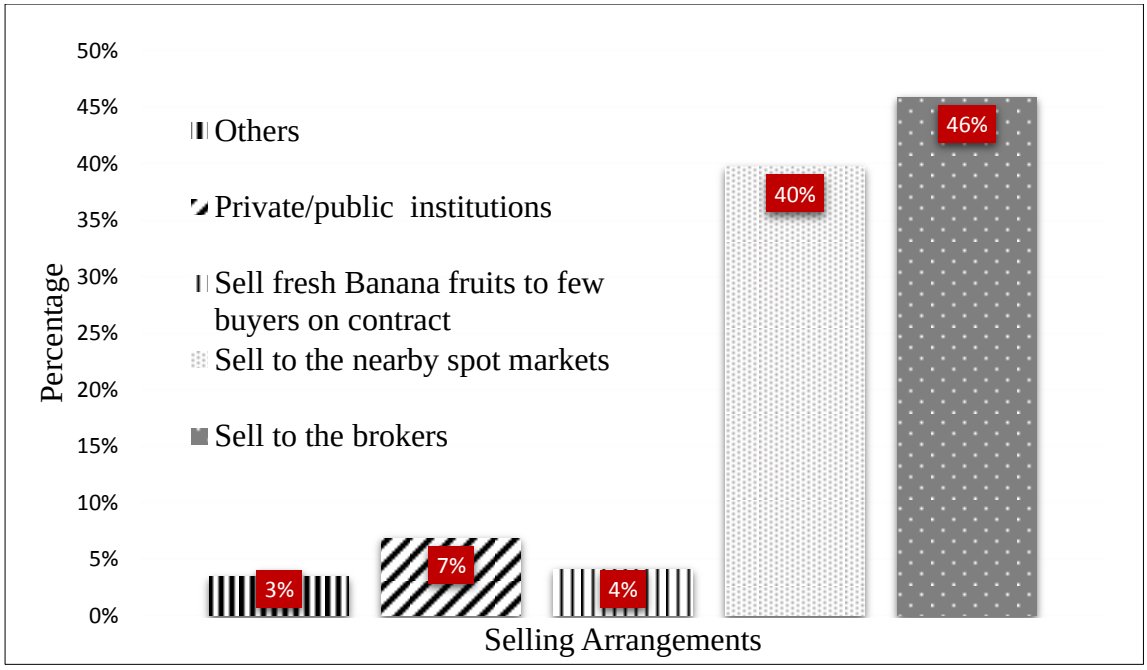


Figure 4: The selling Arrangements of Banana Farmers in Meru County.

The study also found that 7% of the farmers sold to either public or private institutions. This was the case of intermediary-driven business models. Farmers preferred intermediaries to provide them with technical assistance and provide support services in identifying and improving smallholder market linkages (Kelly, 2011).

The study also aimed at identifying the reasons why smallholders, for example, would prefer buyer-driven model and not producer-driven model. It was found that farmers were more interested in higher prices (70%), provision for farm input (63%), increased profits (55%) and ready market. This can be explained through the rationality principle and the profit maximization regime that any business would seek. According to rationality principle, farmers would rather sell where they maximize their utility and income with certainty than engage in selling arrangements full of ambiguities and uncertainty. In addition, profit maximization as a business goal drove most farmers to seek good prices. Combining the findings on selling arrangement and the reasons behind such arrangement revealed that most smallholders preferred buyer-driven models where they exercised freedom of entry and exit in pursuit of profit maximization.

The findings of Carriquiry and Bruce (2004) again provided insight into this issue. The authors found an inter-play between profit maximization and choosing a particular business model. They found that increasing premiums in the cases of contractual arrangements reduced people's preferences for spot markets. They posited that eliminating a spot market, is

perhaps implausible in the near future because smallholders seek profit maximization and would rather sell through spot markets if other business models fail.

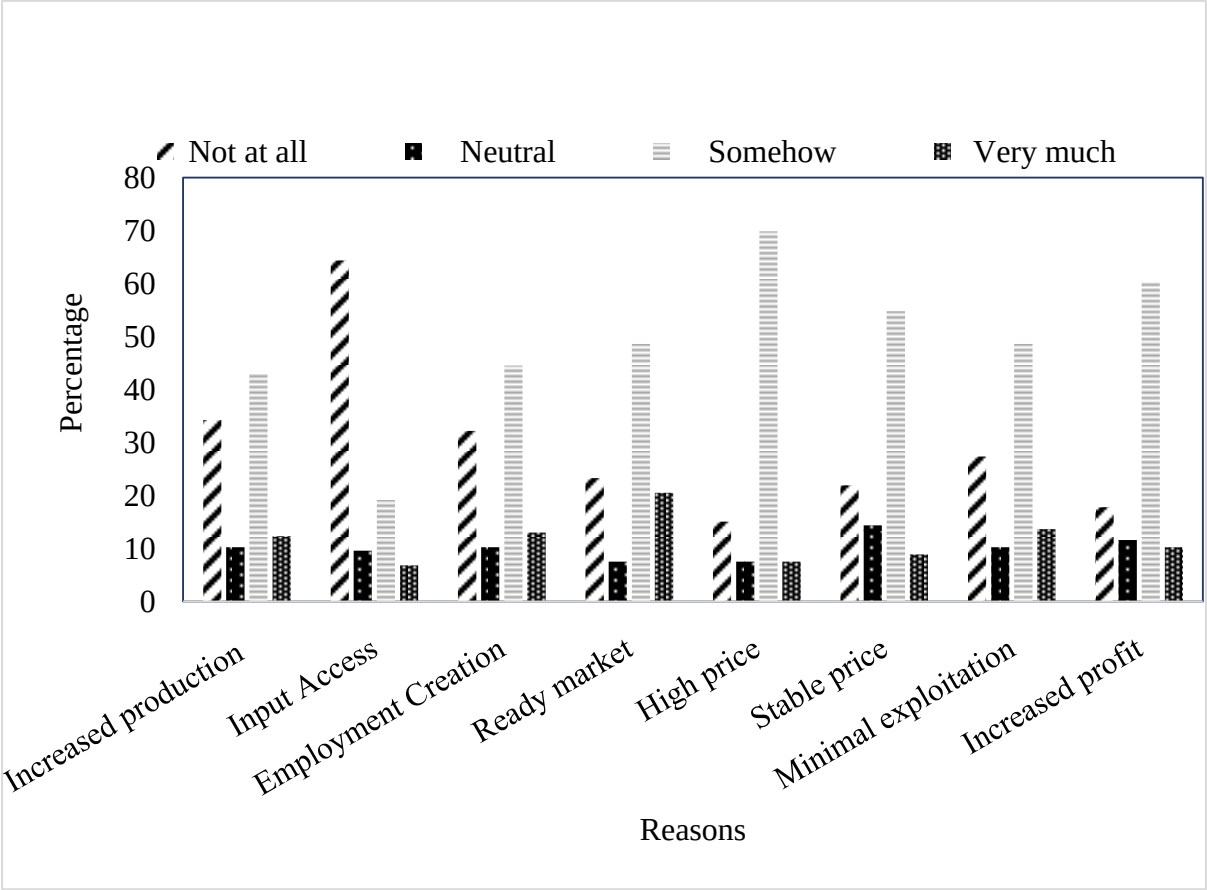


Figure 5: Reasons for Selling Arrangement used in Implementing Business Models

4.3 Socio-Economic Factors Influencing the Choice of a Business Model by the Farmer

Table 8 below presents the multinomial logistic results with estimated coefficients (β values), their level of significance and marginal effects of such factors. The study has incorporated basic tests and theories related to multinomial logit model in interpreting the results. In particular, the three marginal probabilities of each variable were summed. The sum was expected to equal to zero, because of effects of mutually exclusivity of decisions that cancelled each other out. This property of the multinomial probit model was therefore achieved thus proving that the choice of the model relative to univariate approaches was sound (Dorfman, 1996). Marginal effects coefficients' were presented to give measures of expected change in the dependent for every unit change in the independent variable, *ceteris paribus.* Following Pundo and Fraser (2006), the study presented both positive and negative values implying either increase or decrease in the likelihood of choosing among the alternative business models. The likelihood ratio chi-square of -95.577 with a p-value < 0.001

revealed that the model as a whole fitted significantly better than a model with no independent variables at all. Thus, the study rejected the null hypothesis that all of the regression coefficients across the models was simultaneously equal to zero. The $p<0.0001$ was significant at 1 percent, thus it was concluded that at least one of the regression coefficients in the model was not equal to zero. The findings therefore led into conclusion that the multinomial logistic model best explained the effect of socio-economic factors on business models better than other univariate models. Other studies such as Dorfman (1996) reached the same conclusions about using multinomial logit model.

Buyer-driven model

Table 8 shows Multinomial Logit estimates and the marginal effects for factors that influenced the choice of the three categories of the business models. These categories were: buyer-driven model, producer-driven model and intermediary-driven model. The various marginal effects are discussed along with their significance level. First, the study found that if a banana seller was female, the likelihood of choosing buyer driven model increased by 9.9 percent compared to the male counterparts. Female variable was significant and positive at 10 percent. This can be attributed to the fact that agriculture in general and marketing of agricultural products in particular have been viewed as women's' activity in Sub-Saharan Africa. A study conducted by Mukindia (2014) corroborates these findings. The study found that women in Meru County were actively involved in selling of banana especially to brokers than their male counterparts. In addition, a one-year increase to the age of a farmer increased the likelihood of choosing a buyer-driven model by 0.8 percent. Age is associated with experience in selling and there exist repeated experiences with same buyers who farmers find trust. Thus, they are more likely to sell to such buyers and agents than new marketing agents. Ojo, Nwosu and Omeje (2013) reached the same conclusions.

If a farmer initiated market linkage through their farmer group, they were 31.9 percent more likely to choose a buyer-driven model. However, if either government or NGOs initiated a farmer's market linkage, they were 10.9 percent less likely to choose the same model. The first case may be associated with the fact that being in groups was more likely to push farmers to sell banana in a particular market following the group agreements and conditions placed. The second case may be attributed to the fact that marketing initiators such as government and NGOs are usually more likely to provide market incentives that would make farmers be involved actively in marketing with their initiated linkages than other linkages such as through brokers. Initiators match the smallholder farmers to specific agents along the

value chain. Findings of Minten, Reardon and Vandeplas (2009) support this because the authors found that farmers who had agents to initiate negotiations between them and other agents were more likely to get a stable matching. Besides, they were more likely to get credit and insurance contracts for their crops.

The study also found that a one Kenya Shillings increase in marketing cost increased the likelihood of choosing buyer-driven model as compared to producer-driven and intermediary-driven models by 0.3%. This could be explained based on distance to market and transaction cost. Buyer driven models offer smallholders opportunities to be linked with large retailers thus share cost of transportation with them. Besides, buyer driven models are associated with spot markets whereby farmers who are nearby markets can sell at own pace and time. Findings of Magogo *et al.* (2015) argued in the same line that farmers preferred brokers or large retailers because they catered for any additional marketing costs. A one Kenya shilling increase in total income increased the likelihood of choosing buyer-driven model compared to other models by 7.4 percent. Income acts as incentive and motivates the farmer to produce and sell more. As such, buyer-driven models were likely to influence other value chain players to offer better prices due to competition, which positively influenced the smallholders' income. The findings from rapid growth of Chinese agriculture as argued by Ru, Li, and Lu (2007) corroborate these results. Rapid growth was from household business growth and strengthening of broker linkages. Thus, those farmers who were linked to high value markets were likely to have better incomes. Household size was not significant just like land.

Producer-driven Model

If a banana seller had primary education, the likelihood of choosing a producer-driven model increased by 43.2 percent. Likewise, banana sellers who had secondary education were more likely to choose producer-driven models by 18.9 percent. The variable was significant at 1 percent for both primary and secondary school variables; meaning that it significantly influenced the choice of producer-driven model. The reason for this may be that households that are more educated are more likely to make better market linkage decisions and are more likely to exploit avenues that give them more information on the business of selling banana. Besides, they are more likely to be better adopters of business models than the illiterate ones. Dorfman (1996) reached the conclusion that higher education level was more likely to make a farmer more likely to adopt different farming models. This is corroborated by findings of Ngugi and Kariuki (2009) that the more a person is educated, the more likely they get involved in producer organizations.

Having a group membership increased the likelihood of choosing a producer driven model by 20 percent compared to belonging to no group. This was significant at 10 percent. This may be attributed to the fact that group membership is associated with collective action that is achievable through producer cum supplier groups. Findings of Lessmeister (2007) that producer-driven models lead to higher incomes indeed support these findings. The author argued that producer-driven models benefits from group dynamism with more capital and knowledge of marketing techniques due group dynamism. The group members exploit their collective action and have higher negotiating powers to form consumer co-operatives that result in better welfare to their members. The study also found that a one Kenya Shilling increase in banana farmer's income increased the likelihood of choosing a producer-driven model by 5.3 percent compared to adopting buyer-driven and intermediary-driven models. The marginal effect coefficient is statistically significant at 1 percent meaning that income indeed has effect on choice of producer-driven model. This may be explained that farmers get motivated by higher and assured incomes, thus are more likely to make better choices. Also, in producer-driven models, farmers are likely to share the transaction costs among the group members that reduce the overall costs and increase the income.

Studies by Kohansal1 and Firoozzare (2013) who indicated that better incomes lead to better choices of foods for consumption support these findings. This is corroborated by the findings of Fischer and Qaim (2012a) that membership to producer-led organizations such as producer co-operatives leads to higher prices and higher farm incomes among the smallholder banana farmers in Kenya. If banana sellers initiated market linkages through their groups or co-operatives, they were 10.2 percent more likely to choose producer-driven models than buyer or intermediary-driven model. Likewise, if the government or NGOs initiated market linkage, smallholder banana sellers were 13.8 percent more likely to choose producer-driven model. For the first case, it may be because producer-driven models are created by individual and group initiatives, driven by objective of achieving a common economic advantage and thrive from within group problem solving initiatives. Initiators can be leaders and can as well elicit group behaviour to enable producers utilize common objectives.

Table 8: Multinomial Logit Estimates and Marginal Effects for Factors Influencing the Choice of Business Models

Explanatory Variables		Buyer-driven			Producer-driven			Intermediary-driven		
		Marginal Effects	Std. err	p>|z|	Marginal Effects	Std. err	p>|z|	Marginal Effects	Std. err	p>|z|
Sex	Male	0.029	0.102	0.779	-0.050	-0.490	0.621	0.021	1.120	0.264
	Female	0.099	0.053	0.060*	-0.018	0.078	0.813	-0.081	0.082	0.325
Education	level:									
Primary		-0.261	0.2230	0.2410	0.432	0.053	0.000***	-0.170	0.218	0.435
	Secondary	-0.108	0.226	0.63	0.189	0.054	0.000***	-0.080	0.221	0.718
	Tertiary	0.250	0.216	0.2480	0.000	0.001	1.000	-0.250	0.216	0.248
Initiator:	Farmer grp	0.319	0.189	0.091***	-0.134	0.138	0.032*	-0.185	0.192	0.336
	Buyer	0.057	0.155	0.711	0.056	0.197	0.776	-0.113	0.209	0.587
	Government/NGOs	-0.109	0.029	0.000***	0.580	0.102	0.000***	-0.471	0.104	0.000***
Age		0.008	0.008	0.098*	0.000	-0.710	0.480	0.702	1.090	0.274
Belonging to a group[#]		0.190	0.118	0.107	0.201	-1.700	0.089*	0.011	1.080	0.279
Household Size		0.003	0.031	0.918	-0.005	0.031	0.876	0.002	0.002	0.422
Total income		0.074	0.0723	0.088*	0.053	0.072	0.006***	-0.127	0.016	0.192
Ready market		0.015	0.049	0.754	-0.031	-0.640	0.520	0.016	1.180	0.239
Land Size for Banana		0.045	0.082	0.582	-0.041	0.082	0.615	-0.004	0.006	0.525

LR chi2(20) = 86.18 **N = 146** **Chi2 = 0.000*** ** **Pseudo R^2 = 0.3130** **Log likelihood = -95.577**

*** Significant at 1% level; ** significant at 5% level; and * significant at 10 % level.

Furrer et al. (2012) corroborate the findings above. For the government/NGOs initiatives, incentives and assurance of markets may be the biggest driver for choosing producer-driven groups. Besides, government of Kenya has encouraged and supported farmer groups and co-operatives through specialized loans and support that encourage farmers to come together and exploit their common initiatives.

Intermediary-driven Models

Additionally, if government or NGOs initiated a market linkage, banana farmers in Meru County were 47.1 percent less likely to choose intermediary-driven model. This variable was significant at 1 percent, meaning initiators highly influenced the choice of a business model. This finding was contrary to the expectation that market linkages initiated by governments and other market agents would promote adoption of buyer-driven models. Perhaps this can due to compliance with standards and procedures associated with governments and NGOs that smallholders may not cope with. Besides, market liberalization requires the "invisible hands" to play and government interference may cause disequilibrium and financial repressions. These crowds out smallholders who like a free market where equilibrium is achieved. Findings of Zarra-Nezhad, Sajjad and Anvari (2011) corroborate this result.

4.4 Effect of Business Models on Income

4.4.1 Gross Margin Analysis

This section highlights the effect that business models have on smallholders' gross margins. The mean gross margin for both direct and group sales was KES 14,723.60 with a standard deviation of KES 12,546.38. Thus, the monthly mean income for banana sellers was 1226.97 Kenya Shillings. This translated to only 40.90 Kenya Shillings per day. For ease of understanding, the gross margin was divided into categories. As evidenced in Table 9 below, those who used intermediary-driven models had the least gross margin compared to those of buyer-driven and producer-driven. This may not mean that incomes solely influence the choice of business models, but act as a decisive factors when choosing the business model. This may be associated with additional costs incurred by farmers such as registration fees, membership fees and contributions towards member welfare. Results from cowpea study by Zulu (2011) support these findings because it was found that those households that were linked to the market through other agents especially NGOs and governments had the least gross margin. As shown in Table 9, those farmers who had Gross Margins between KES 40,001 and KES 79,950 mainly chose buyer-driven models. This may be attributed to the fact that these smallholder farmers incurred little cost in maintaining their supply chain as

compared to the other groups. It can also be attributed to minimal obligations required such as contribution towards group activities and co-operatives like in the case of producer-driven model. Besides, intermediary-driven models are always associated with regulations from third parties to meet customer needs that add cost to the business. Lessmeister (2007) found that intermediary-driven models have information and search costs, bargaining costs), monitoring costs and enforcement and policy costs contribute directly to lower GM for farmers linked in market through such models.

Table 9: Results of Descriptive Statistics of GM of Different Business Models.

Gross Margin (KES)	Buyer-driven	Producer-driven	Intermediary-driven	Total
GM=(1000 to 20000)	75.31	83.33	88.24	79.45
GM=(20001 to 40000)	17.28	16.67	11.76	16.44
GM=(40001 to 60000)	3.7	0	0	2.05
GM=(60001 to 79950)	3.7	0	0	2.05
Total percentage	100	100	100	100

4.4.2 Quantile Regression Results for Factors Affecting Gross Margin

Table 10 shows the quantile regression results for the effect of business models and other socio-economic factors on Gross Margin. First, the study tested the null hypothesis that error variances were equal versus that of alternative hypothesis that error variances were likely to be multiplicative function of a single or more of the variable. The probability Chi-squared was not significant at 1%, 5% and 10% thus null hypothesis for existence of heteroscedasticity was rejected. This is shown in the analysis below:

Breusch-Pagan / Cook-Weisberg test for heteroscedasticity

H_o: Constant variance

$H_{a:}$ No constant variance

Variables: fitted values of GM

Chi^2 (1) = 0.64

Prob. > chi^2=0.519

It is therefore concluded that the case of heteroscedasticity was absent given the Breusch-Pagan test. This also means that the variance around the regression line is the same for all values of the predictor variables included in this analysis.

The median income for the banana farmers in Meru County between 2013 and 2014 was KES 11000. This was an average of 916.67 Kenya Shillings per month and 30.56 Kenya Shillings

per day. Monthly sales was significant at 1% ($p<0.001$) and positive at the 25^{th}, 50^{th} and 75^{th} quartiles. This indicated that one Kenya shilling increase in sales resulted into a 32.8% increase in the median gross margin. This was attributed to the fact that the higher sales motivated farmers to produce more and thus earn better from banana farming. Most smallholders who were in a position to sell their banana especially through buyer-driven and producer-driven business models reported higher GMs compared to those who sold through intermediaries. Wanjala, Njehia and Murithi (2015) in determining factors that influence milk yields reported that sales significantly influenced "returns" of smallholders.

A one-year increase in banana farmer's age was associated with a 36.9 percent increase in his/her median income. Age was significant at 10% ($p<0.10$) in the 25^{th}, 50^{th}, and 75^{th}quantile meaning that it influenced banana farmer's gross margin within those quartiles. This could be attributed to experience in farming and utilization of collective action together with networks to link with other value chain player. Besides, this could also be attributable to minimal constraints in accessing farming input and lower cost due to utilization of social capital as found by Birachi *et al.* (2013). The other study conducted on cowpea profitability in Zambia identified positive correlation between age and profitability. The regression results yielded that farmers aged between 41-60 years who participated in cowpeas production had higher GM and hence higher profits due to what the author attributed to years of experience.

4.4.3 The effect of Business Models on Gross Margin

Smallholders who chose producer-driven model (_IB_MODEL_2), compared to those who chose buyer-driven (reference category) had a median gross margin 3.9 percent higher, controlling for the other independent factors (Table 10). This was significant at 5% ($p<0.05$).

Table 10: Quantile Regression Results for Factors that Influence Gross Margin.

Total GM	Coefficient	Std. Err.	T	P>|t|
Education level	-0.023	0.034	-0.690	0.492
Log of Monthly Sales	0.328	0.042	7.740	0.000***
Land Size	0.033	0.031	1.070	0.084*
_IB_MODEL_3	0.006	0.006	0.023	0.250
_IB_MODEL_2	0.039	0.016	2.460	0.015**
Age squared	0.369	0.633	0.580	0.056*
Constant	-0.302	0.166	-1.820	0.071

Likewise, smallholders who chose intermediary-driven model (_IB_MODEL_3), compared to those who chose buyer-driven (reference category) had a median Gross Margin 0.06 percent higher, controlling for the other independent variables. This was not significant. On the other hand, banana farmers who chose producer-driven (_IB_MODEL_2) compared to those who chose intermediary-driven (_IB_MODEL_3) had median Gross Margin 3.84 percent higher, *ceteris paribus*. The explanation for seemingly high preference for producer-driven models is that it is associated with high member welfare issues such as reducing poverty, members' children education and collective action.

Producer-driven models utilize members' opinions and contributions to better their livelihoods. Thus, smallholders who chose the model were highly likely to get more GM than those of other models. The findings of Singh, Kavadias and Subramanian (2015), further indicate that pro-producer agriculture value chains were better in providing pathways for poverty reduction and inclusivity than other business models. Even though the initial analysis showed buyer-driven models to provide quick GM over a short period, its sustainability was shown to be jeopardized in the end. The robust findings using quantile regression at 25%, 50% and 75% showed a contrary to the first finding. Thus, it was concluded that producer-driven models are highly likely to have a long time effect on the smallholders' GMs than the temporality provided by intermediary-driven models.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Conclusions

Objective 1: The study has reconsidered the business model in agricultural context to analyse the marketing dynamic of banana using a sample of banana farmers from Meru County. Besides, the study has developed an agent matching theory that may fasten the move to link smallholder farmers to these high value markets. However, these business models were first characterized. Characterization of business models in terms of the most preferred/popularity indicated buyer-driven model to be the most commonly used. It significantly differed across sex, age groups, education level and even geographical location. In terms of farmer's welfare, producer-driven model emerged as the better model and highly depended on age, membership to a producer group and education level. In terms of typology, buyer-driven model had four types that included sharecropping, joint ventures, contract farming and contract marketing. The types of producer-driven models were joint ventures, group hired land, contract farming and contract marketing. For intermediary-driven models, the types included hired land and contract marketing. It emerged that group membership, education level and initiating a market linkage whether by oneself or government significantly influenced adoption of a given business model. Also, size of land and years of experience of a farmer influenced their use of business models. Most farmers indicated price as the biggest driver of their preference for different business models. Additionally, they preferred brokers and spot markets to sell their banana.

Objective 2: Multinomial logistic regression results showed that education level, initiator, age, total cost and total income significantly influenced the preferences for the three categories of business models. It strongly emerged that there is need for having an initiator of the process of trying to link farmers to high value markets than to let them figure out what the game of marketing banana is all about. Income significantly influenced the choices for buyer-driven and producer-driven models but not for intermediary-driven models. Therefore, business models that promote higher incomes were more likely to be adopted. Age significantly influenced buyer-driven and producer-driven models. Likewise, group membership played a major role in determining the adoption of producer-driven models.

Objective 3: Gross margin analysis revealed that most farmers rarely made more than 20,000 Kenya shillings per month. This meant that they made an average of 1666.67 Kenya shillings

on 1-acre piece of land per month and an average of 55 Kenya Shillings per day. This is below a dollar per day and means that smallholders' banana farmers are among the 3 billion of world's population that lives below two dollars per day. It therefore meant that most smallholders do not benefit much from banana farming especially for buyer-driven and intermediary-driven adopters. Also, it can be concluded that producer-driven model promoted farmers welfare better as indicated by higher GM that was significant at 5 percent.

5.2 Recommendations

Improving value chain profitability needs inclusivity and building resilience where market fails to meet expectations. As revealed by this study, business models are important farm revenue architectures that if put into practice can improve farmers' income. There should be promotion of producer-driven models to enable farmers share information, utilize their social capital and have better Gross Margins. Besides, Gross Margin analysis revealed that producer-driven model was highly likely to lead to higher gross margins. Also, stakeholders such as value chain agents and government of Kenya should create policies that promote groups membership. Group membership was found to improve farmers' income and choice for producer-driven models apart from bridging the income gap for the members. The government should develop policies that encourage literacy levels to go higher in the county. The government and concerned NGOs should discourage issues that reduce land sizes such as defragmentation and encourage land consolidation to give smallholders more supplier powers. Banana buyers should provide incentives and fair pricing that offset the transaction costs that smallholders incur to produce and market their banana.

5.3 Further Research

A complete description of the business model design and resolution of the farmer-agent matching paradox remains an open challenge, which this study has presented new theory and concrete econometric models to address. The study focused entirely on linking farmers to markets and partially went further to suggest a theorem based on game-theory approach. Thus, testing of this theory is necessary and the aspect of its generalization needs panel data. Besides, business models in Meru County may be different from other areas that grow banana. Thus, drawing similar conclusions may need longitudinal data and large areas such as the whole country. Lastly, the unresolved algorithms presented that require need of institutional analysis of human behaviour and the matching theory developed here needs solutions and testing and require understanding of empirical evidences to understand how markets work, and the extent to which market failures can be avoided.

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